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Handling Wheel and Axle Work on the Brooklyn-Manhattan Railways

By Fred H. Colvin
Editor, *American Machinist*

How cars are inspected and motor trucks handled when axles or tires require repairs

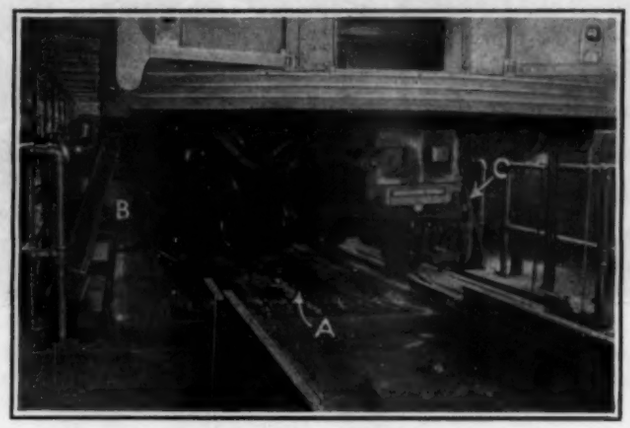


Fig. 1—Dropping truck from car

A novel wheel-turning department with storage tracks and hoist for wheels and also for chips

ONE of the first considerations in connection with rapid transit railroading, especially in the New York district, is the handling of work with the least delay. To accomplish this the New York Rapid Transit Corp., formerly known as the B.R.T. or Brooklyn Rapid Transit Co., has paid particular attention to the installation of quick handling devices in its various shops. An interesting example can be seen in the shop at 36th St. and 5th Ave., Brooklyn, where wheel and journal work is handled, the motors being overhauled and repaired at 39th St. and 3rd Ave., a few blocks away.

When a car truck has developed either flat spots or sharp flanges it is run, under its own power, to the train shed at 36th St. The truck to be removed is run on the elevator shown at A, Fig. 1, the elevator raised enough to lift the car so that the supports *B* and *C* can be swung over, under the sill of the car and the elevator is then lowered so that the truck drops away from the car, leaving it on the supports.

The truck is dropped to the floor below, run out on a track to the shop shown in Fig. 2, and is then ready to have the wheels removed for turning. Another truck is then run on the elevator, lifted up under the car, which is raised off the supports, or jacks, lowered to the proper level, and run off to make room for another car. A spare truck with motor can be used, and the car put into active service at once, or a plain truck can be used just to support the car and to enable it to be run off on to a storage track until its own truck is ready for use. The elevator is of the plunger type having a plunger approximately 24 in. in diameter.

The trucks come into the shop, Fig. 2, from the left, and the wheels are taken out by lifting the truck off the axles. The axles are rolled under the jib crane supports at *A* and lifted to the upper track at *B* by a traveling crane which runs at right angles to it. The structure *A* also supports one end of the traveling crane. The two jib-cranes have long arms that cover a large radius, and are equipped with air hoists.

The wheels to be turned are placed on the upper track at *B*, Fig. 2, and can be either rolled along the track or lifted and carried by a crane which serves the wheel turning department. The wheel work can be seen more in detail in Figs. 3 and 4, which show the end of the tracks and the Sellers wheel lathe.

The electric hoist, shown at *A* over the track in Fig. 3, travels on a monorail and can pick out any desired pair of wheels and carry it to the wheel lathe at the end of the track. The wheel lathe is in a room built especially for it, and connected with the main shop by a narrow passage which contains the upper track, *B*, Fig. 2.

The monorail hoist also handles the chip pan, *B*, Fig. 3, which rests in the pit between the lower wheel tracks to receive the wheel turnings with the minimum of labor. The chip pan is then handled on the small truck shown beneath it. The protector for the journal on the axle, is shown at *C*.

A precaution against delay due to breakdown of the electric hoist is provided by the hand chain-hoist at *D* which is held in reserve for such emergencies.

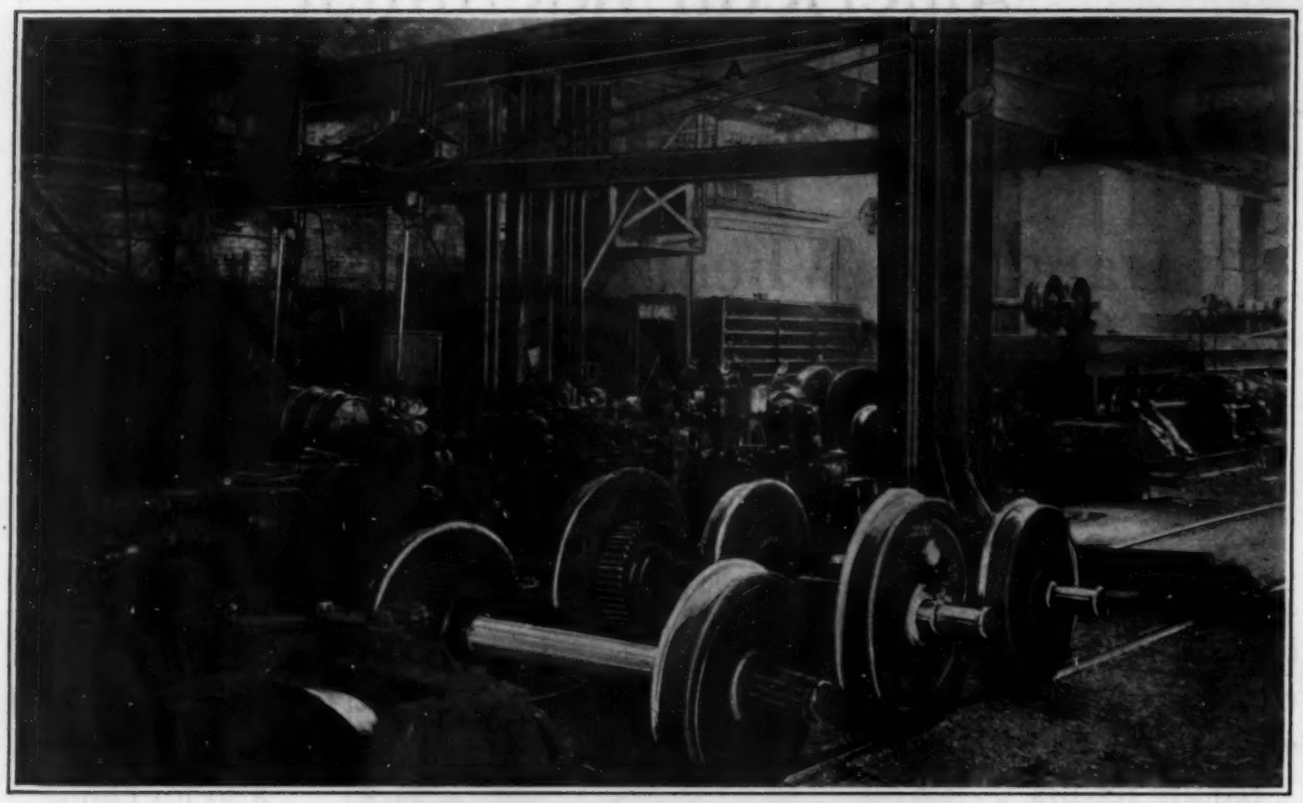
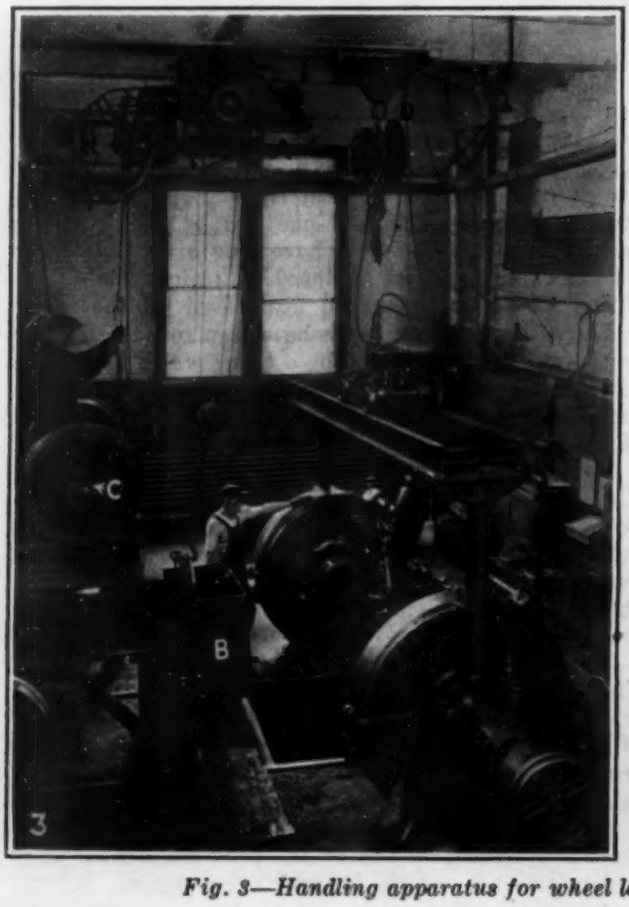


Fig. 2—General view of truck inspection



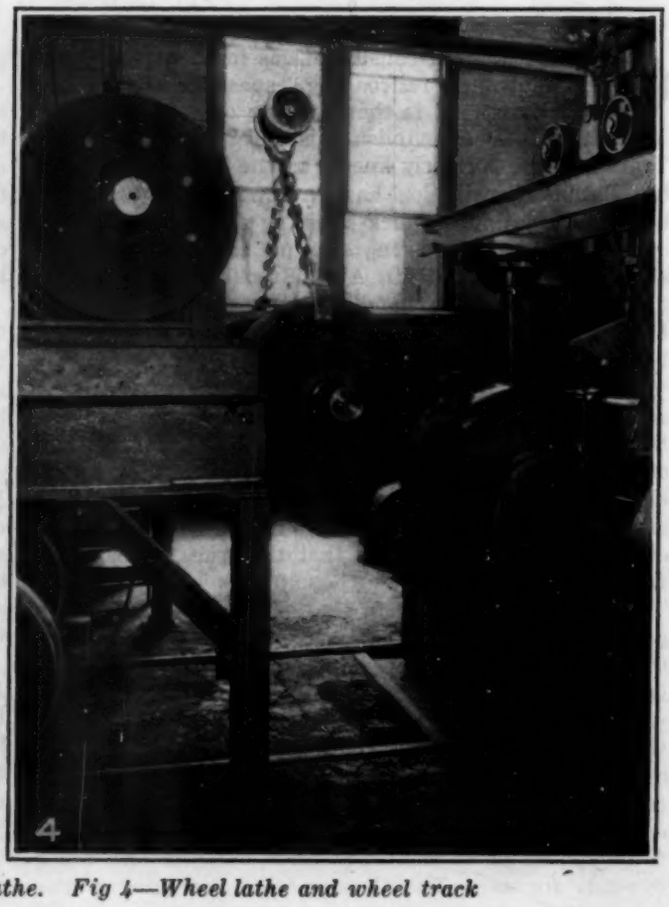


Fig. 3—Handling apparatus for wheel lathe. Fig 4—Wheel lathe and wheel track

Fig. 4 shows a close-up of the end of the wheel tracks and of the wheel lathe with its air hoist, lifting hooks, etc. The view shows a pair of wheels just being put in place in the lathe and another pair hanging ready to go in. When the two wheels on an axle are turned the unit is let down to the lower track and rolled back under the upper track, which holds the tires waiting to be turned. The return or lower track for finished wheels can also be seen in Figs. 2 and 3.

The efficiency of the combination outfit is indicated by the output of two pairs of wheels per hour from floor to floor for the lathe man and one helper. This is not a record but an average performance which is all that really counts.

The journal bearings are also fitted in this same shop, although no special equipment is used. Babbitt lined bearings are used with a brass plate in the end to take the end-thrust of the axles. The wear plates are put in when the box is new and replaced when worn. In this way the end of the box itself is not weakened by the wear. The end plates are held by rivets which are easily removed when renewal becomes necessary.

The bearings are babbitted in the East New York repair shop and come to 36th St., to be bored to fit the axle journals. They are bored, in pairs, in a pot chuck in the usual manner.

The train shed also has inspection pits for making it easy to examine the motor trucks. The pits are whitewashed monthly which aids inspection by reflecting light on the trucks and other parts.

Metal Spraying and Sprayed Metal

By T. Henry Turner and W. E. Ballard

IN THE dozen or more years since the process was introduced, many designs of pistol or other spraying apparatus have been constructed, but the space at our disposal does not permit of reference to all of these, nor to the interesting history of the development of the invention itself.

The unit of all the metal-spraying processes of today is the wire spraying pistol, a small and handy apparatus, similar in appearance to a paint pistol, but differing in its operation and design. The wire is pulled into the pistol and pushed through the nozzle by means of rollers actuated by a small turbine in the case. The pistol is fed with oxygen and some combustible gas under pressure, and also with compressed air, which projects minute particles of metal from the ever-melting end of the wire.

It may be of interest to remark that experiments with pistols using heavier gages of wire have, up to the present been unsuccessful, owing to the difficulty of arranging a blowpipe flame that will melt such wires at a uniform rate and yet allow for the complete pulverization of the metal as soon as it is molten. Attempts have been made to use metallic ribbons, but the apparatus has been found to be too heavy and unreliable for commercial use. The metal-spraying pistol will spray all metals that can be obtained in wire form and which will fuse in the oxy-hydrogen flame. The metal magnesium is an exception to this general rule.

Spraying Inside Tubes

The interiors of tubes may be sprayed by attaching to the ordinary pistol a long adapter, at the end of which a rotating nozzle is fixed. This produces a fan-shaped spray, and is driven by the air-blast used for projecting the metal. Thus, with the same unit, or pistol, tubes up to 12 ft. or so in length may be coated internally, so long as they are of sufficiently large bore to allow the introduction of the rotating end—that is to say, 1¼ in. or more in internal diameter. The preparatory sand-blasting of tubes internally presents some difficulty.

The present-day practice is to sand-blast almost every article which is to be metal sprayed, and it is strongly advocated that where possible the article to be sprayed be heated. Devices are in use with which heating, sand-blasting, and spraying are carried out mechanically in one and the same machine. For metal work, sand-blast pressures of about 30 lb. per sq.in. and the use of hard black flint sands of about 20-mesh grade are recommended. After sand-blasting the surface should be sprayed at once, to avoid the possibility of contamination with grease and dirt.

Although the process has been in use for a considerable number of years, little appears to have been known as to the actual mechanism of the spraying process. It was not known whether molten or solid particles actually struck the article which was being sprayed.

A Union Without Alloying

By cutting a cross-section through a sprayed coating one may observe the union between the foundation metal and the sprayed metal. Remarkably little or no alloying appears to take place. Sand-blasting produces a vast number of minute pits, some of which retain particles of sand. It is an undoubted fact, however, that the coatings applied after sand-blasting do adhere better than those applied to a smooth surface, or even to a surface etched by acid.

The explanation of this adherence with little or no alloying is probably very complex, but it is evident that the rough surface does not permit the particles to glance or splash off, or to be forced off by the air stream so easily as with a smooth surface. The full value of the impact is therefore obtained. Cooling is extremely rapid, and probably causes the sprayed mass to shrink on to the projecting portions of the surface. When examining such sections under the microscope, one observes that the sand-blasted surface of the foundation metal is severely strained. This distortion of the surface crystals of the foundation metal may possibly aid the adherence of a coating by encouraging slight movement. Such local deformation, causing a gripping of the sprayed metal, might occur when in contact with hot particles.

The absence of definite alloying will be observed, and it should also be mentioned in this connection that sprayed zinc coatings are of pure zinc alone, with no intermediate alloy. This is a distinct advantage, as many workers have proved that the iron-zinc intermediate layer formed in hot-galvanizing aids the corrosion of the steel base.

Abstract of a paper present at a meeting of the Institute of Metals, London, England, September 8-11, 1924.

The surface of sprayed metal is always matte unless it be subsequently polished. It would be well, therefore, to point out that the chief objection to the use of sprayed metals has been that they have been found to be porous. By careful manipulation of air pressures it is quite possible to spray coatings of tin, lead, and zinc that will be absolutely non-porous to liquids. It has, however, been found impossible to make coatings of aluminum, copper, brass, and the higher melting-point metals non-porous by means of the pistol alone. The speed of spraying and the distance of the pistol from the work influence the nature of the coating produced. It has been found possible to metal-spray a piece of metallic sodium with so non-porous a coating of lead and tin that no action occurred when the sprayed sodium was thrown into water.

There are, however, three methods which may be, and are employed in commerce today, for making sprayed coatings non-porous—viz., mechanical, thermal, and chemical.

1. Mechanical work (such as hammering, wire-brushing, or blasting with ball shot) does not give perfect satisfaction and is cumbersome. This method is not used where other methods are applicable.

2. Non-porous coatings may be produced by spraying on to articles that have been heated to a suitable temperature, depending upon the metal which has to be sprayed. A temperature of 220 deg. C., for example, is suitable for lead spraying. Heating has also been accomplished by encompassing the spraying nozzle with a number of blowpipe jets.

3. Very good results have been obtained by precipitating within the pores of the metal an insoluble non-poisonous chemical compound.

So far as adhesion is concerned, no special tests have been made by the present authors. But it suffices to say that sprayed metal adheres sufficiently well both to itself and to other metals or non-metals to allow it to be filed. That sprayed metal can show considerable resistance to erosion may be gathered from the fact that it is being used successfully as a coating on ships' propellers.

Nature of Material Important

In present-day practice, composite coatings are frequently employed, and since the process is much used for acid or corrosion resisting, it is most necessary to consider the nature of the material sprayed and sprayed upon. The composite coatings of more than one metal have given in some cases resistance to corrosion which justifies further use and investigation. For example, zinc followed by aluminum is very suitable in cases of attack by atmospheres containing SO_2. It has been shown that the successful composite coatings are those of metals nearly related in the electrochemical series. Very good results have been obtained by spraying zinc upon iron and steel objects —this has the advantage over practically all other methods of corrosion resistance.

When this investigation was commenced, it was not known whether it would be possible to spray really solid lumps of metal; that is to say, we questioned the homogeneity of sprayed material. In a steel mold, copper, zinc, tin, aluminum, and iron bars were produced by spraying longitudinally for one set of tests, and transversely for a second set of tests. It was found that the bars so produced could all be sawed, filed, planed, turned, and machined much in the same way as solid metal. The bars had a clear metallic ring when struck. This latter point was of especial interest to the authors, because it has been stated elsewhere that such bodies entirely lack resonance.

The process is at the present time used in France and Germany to a considerable extent on shipping work, and for the protection of overhead transmission-line poles and wireless masts for big stations. It is being increasingly used in this country for the protection of certain portions of ships and for propellers. Both wooden and steel bulkheads are being coated with zinc in many shipyards.

There are very many uses which can only be set down in summary. Among these are the protection of the steel of vulcanizing pans, protection by tinning of tanks intended for foodstuffs, and the coating with zinc or aluminum of containers intended for crude or light oils.

By continuous spraying on one spot, one may build up a material suitable for much of the repair and salvaging work required in engineering shops and foundries.

Famous Machinists of History

By H. H. Manchester

Sir Josiah Mason (1795-1881)

Josiah Mason was the son of a poor weaver in Kidderminster, where he was born in 1795.

From about eight years of age Josiah tried one occupation after another until he finally found success. At first he sold on the street cakes which his mother made. Not long afterwards the mother started a small grocery and bakery, and Josiah assisted her.

As a young man he tried his hand as a house painter, a blacksmith, and a maker of toys. In spite of his many changes of occupation, he was known to be dependable, and finally, a man who was retiring from the business of making barrel hoops, offered to sell him the shop mostly on credit. Mason accepted the opportunity, and not long afterwards invented a machine for doing the work, as a result of which he cleared £1,000 the first year.

Some steel pens, which were just coming into use, attracted his attention, but after trying them he thought they were crude and unfinished. That night he personally made three in his shop, and sent one to Perry, of London. It was so great an improvement that Perry at once wrote for all he could make.

Mason soon invented various machines for making them, and in a few years employed over a thousand persons, and turned out more than 5,000,000 pens a week. He became a well-known philanthropist, established a great orphanage, and also founded a free school of science at Birmingham.

For such benefactions he was knighted by Queen Victoria. He died at the age of 86 years.

Hints for the Foremen

The ideal foreman is one whose department is running 100 per cent right while he leans back in his chair resting his feet on the desk. But don't get this thing upside down. A man who puts his feet on the desk is not necessarily a good foreman.

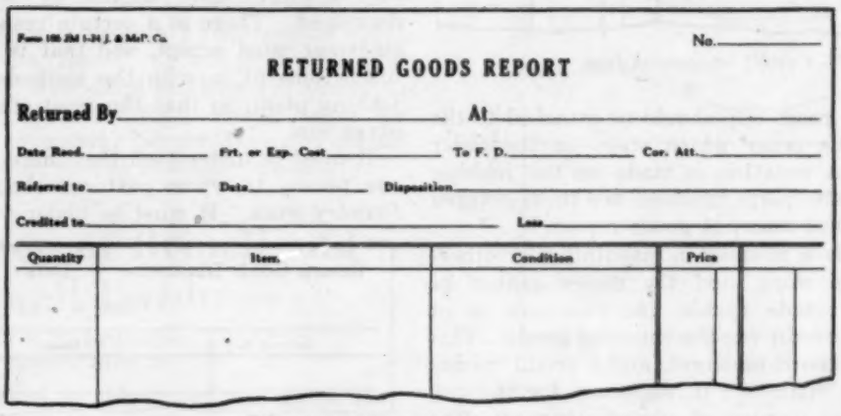
Returned Goods in the Jobbing Plant

By E. W. Leach and J. F. Koch

Returned goods a charge against the profits of the business — Necessary procedure and forms for the disposition of the returned pieces—How returned goods may be decreased

REGARDLESS of how efficient a jobbing plant may be, it is bound to have the problem of returned goods. It may seem to be holding exactly to the customers' specifications; it may have careful, accurate workmen who are trained in their respective tasks; and yet a certain percentage of its output will find its way back to the plant.

Every bit of returned goods is a charge against the profits of the business. It represents a reason for probable dissatisfaction on the part of the customer, perhaps even ill will, and it is, therefore, just as necessary to keep accurate records of returned goods as of shipments. It is also important to analyze the reasons why goods are returned, and see if this drain on profits cannot be kept at an absolute minimum.



RETURNED GOODS REPORT

No.

Returned By _____ At _____

Date Recd. _____ Frt. or Exp. Cost _____ To F. D. _____ Cor. Att. _____

Referred to _____ Date _____ Disposition _____

Credited to _____ Less _____

Quantity	Item	Condition	Price	

Fig. 1—Returned goods report

There are a great many reasons why goods will be returned, usually depending upon the kind of work. Perhaps holes will not be tapped deep enough, holes will be reamed undersize or oversize, sliding fits will be too loose, or any other number of details may be incorrectly handled in the machine shop. Sometimes this will be carelessness on the part of the operator, and sometimes it will be due to incomplete information and specifications furnished by the customer.

It is well to know just what use each part will be put to by the customer. Whether the castings are made in the shop foundry or in an outside place, many of them will have blow holes that will not show up until machining is begun. Familiarity with the customers' products will tell whether these castings should be thrown out. If they should, to go ahead with any further machine work would only be piling up expense on scrap that the customer could not accept.

When returned goods are received, a returned goods report, Fig. 1, should be made out in duplicate by the shipping clerk, storeroom clerk, or whoever takes care of all incoming goods. This report should show the date, the number and kind of pieces received, and the name and address of the customer. Whenever possible it should also show some notation explaining why the goods were returned. By a gradual process of education, the customers may be brought to put this information on their delivery slips. They will gladly do so when they see how it saves time by eliminating telephone calls and letter writing in regard to shipments.

The duplicate copy of the returned goods report stays in the receiving department for a factory record. The original copy goes to the credit manager. The man receiving the returned goods in the factory should attach some kind of tag to one of the pieces or to the box they are in. This tag only needs to show the number of the returned goods report covering these particular pieces. It serves as a means for easy identification of the goods when the time comes for their disposition. The credit manager looks up the order under which the pieces were made. He then gets in touch with the production department, and together they check the reason for return against the specifications and the work itself. This will show whether the customer was justified in returning the goods.

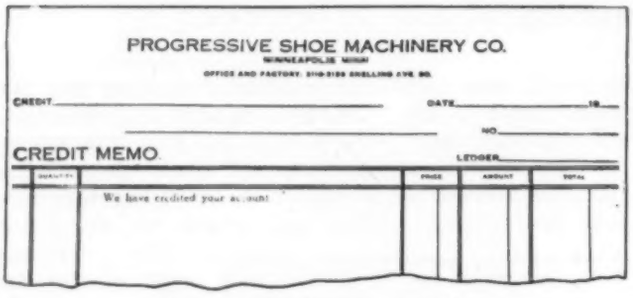
If the trouble is something that is the fault of the jobbing plant, but the work is such that the pieces can be re-machined, the customer should be informed as to what the inspection of the returned goods disclosed. His approval on re-machining them on a no-charge basis should be obtained. This will be the case when holes need to be tapped deeper or reamed larger or some similar work done.

In this case there is no credit memorandum to be made out and mailed to the customer because there are no book-keeping entries involved. The original charge stands; there is no charge for the re-machining. It is simply a case of "send it back and we will make it right." However, a new jobbing order should be entered to cover the re-machining. In this way, proper information of the work will come through to the cost department, and its cost will be charged to overhead

expense instead of being charged to the customer.

In many cases, it will be found that a lack of definite information prevented the machine shop from doing the work exactly as the customer intended. In such instances, if re-machining or some other additional work will put the pieces in usable condition, the extra work should of course be done at the expense of the customer. Here too, no credit memorandum is issued, and the original charge still stands. A new jobbing order for the additional operations is put through in the regular way, and the cost of the work is properly charged to the customer.

In writing up the jobbing order in each of these two


PROGRESSIVE SHOE MACHINERY CO.

CREDIT _____ DATE _____ 19__

NO. _____

CREDIT MEMO

LEDGER _____

		PRICE	AMOUNT	TOTAL
	We have credited your account			

Fig. 2—Credit memorandum

cases, the returned goods slip should be attached to the original copy of the order which stays in the order department files. A notation is made on the jobbing order to show that the parts involved are those covered by a certain numbered returned goods report.

Where it is purely a mistake in machining, or otherwise unsatisfactory work, and the pieces cannot be re-machined to be made usable, the customer is of course entitled to a credit for the returned goods. This is approved by the credit manager, and a credit memorandum, Fig. 2, is made out in duplicate for the full invoice price for the number of pieces returned. The original copy of the credit memorandum is mailed to the customer. The duplicate copy is pinned to the original copy of the returned goods report and passed to the bookkeeper for proper entry on the customer's ledger account.

If more pieces are to be put through to take the place of the unsatisfactory ones returned, a new jobbing order is made out and the work charged for, but of course this charge is offset by the credit memorandum. This has been found to be good practice. It might seem that one could put the new pieces through the shop on a no-charge basis and let the original charge stand, but this method has many bad features.

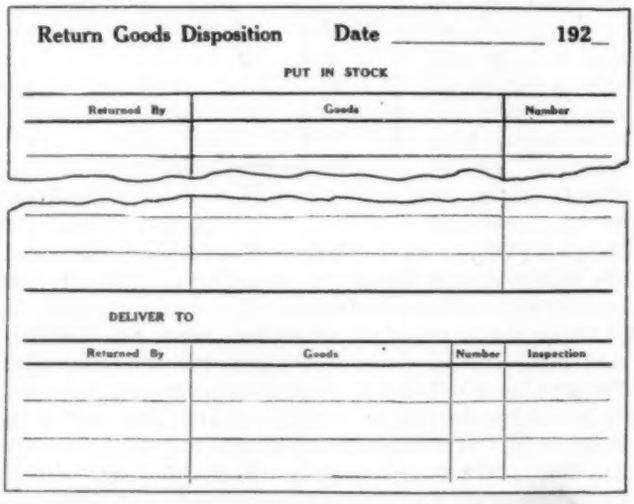
Let us suppose some work was delivered to the customer on September 10th, returned on the 25th, and new work billed October 15th. It stands to reason the customer would not pay for this work until November 10th or 15th. If the original charge were permitted to stand, and if by chance the credit department was not advised about the return of some of the goods, the credit manager would consider the account past due and would act acordingly. This would only antagonize the customer.

Perhaps the most important reason of all why returned goods should be credited and replacement work charged is that this method makes it impossible for the machine shop foreman to try to cover up his own errors without saying anything about it. Naturally the foreman does not like to have mistakes for which he is responsible come to the attention of the management. If this method for handling returned goods is tied up with the method for handling jobbing orders, as described in a previous article by the authors in the *American Machinist*, it will be discovered immediately when someone tries to put work that is not covered by a jobbing order through the shop. It will show up the very same day when costs come through to the cost department for work on which no order has been entered.

At the time the credit department decides what the disposition of the returned goods shall be, a disposition slip, Fig. 3, should be sent into the factory with the proper information and instructions on it. If these are made out promptly, it will tend towards promptness in getting returned goods out of the way. Otherwise, the tendency is to let a lot of miscellaneous scrap accumulate.

In the beginning of this article, returned goods were referred to as a drain on the profits of the business. This is exactly what they are. They probably could never be entirely eliminated in any one plant, but there are unquestionably means by which they can be decreased. There is a certain responsibility which the customer must accept, and that is to be willing to let his actions fit in with the methods and system of the jobbing plant, so that the most efficient service can be given him.

It must be understood that there is but one place and one person to whom patterns should be delivered for foundry work. It must be understood there is but one


Return Goods Disposition Date _____ 192__

PUT IN STOCK

Returned By	Goods	Number

DELIVER TO

Returned By	Goods	Number	Inspection

Fig. 3—Returned goods disposition form

person to whom orders should be given. It must be understood that only one person is authorized to make a promise of delivery, or to give out information about the progress of an order. It must be understood that all business of any kind must be transacted through the office and not direct with the shop.

Now, of course, one cannot seem to "lay down the law" to one's customers. That attitude of approach would certainly be resented. But by means of form letters or through personal conversations they can be taught just where they should go with certain matters. They will then see a definite, clearly-defined organization, and that its smooth functioning in matters of service is purely conditional upon their co-operation. The men in the organization, and especially the department heads, must help out by seeing to it that every-

thing in the way of routine is handled through the proper channels. If both parties will observe these precautions, the returning of goods as unsatisfactory will be materially reduced. For it has been found conclusively that most returned goods are the result of misunderstandings, misinformation, or lack of enough definite information.

When customers bring work to the plant, every effort should be made to obtain the most definite specifications possible. It seems almost unnecessary to say that the shop men should be told that "verbal orders don't go," but the customer is very prone to issue verbal orders, especially the customer who does not instinctively transact his business through the office.

It is an excellent plan for the jobbing plant to have a draftsman for the service of customers who have no facilities for making their own drawings. The men in the shop will become familiar with his style of drawing and his notations, and the prints will be readily understood. Of course, the customer would pay for all drafting work done for him.

Next to the set of complete blue prints is the working model, but this should positively be accompanied by a written memorandum with necessary instructions about allowances, pressed fits, special tap and drill sizes, and all such information. Free-hand sketches are almost as bad as verbal instructions. They should never be accepted. The cost of making proper drawings should be assumed by the shop, if it is absolutely necessary.

Comparison of Brinell and Rockwell Hardness

By S. C. Spalding
Halcomb Steel Co.

THE work described in this paper was undertaken with the idea of comparing the hardness of hardened high-speed steel as measured by the Rockwell hardness tester, with the hardness obtained by the standard Brinell method.

The chemical analysis and heat treatment of the various steels tested are given in Table I. The aim was

Table I—Chemical Analysis and Heat Treatment

	Bar 693 Per Cent	Bar 1734 Per Cent	Bar 1732 Per Cent	Bar 1742 Per Cent	Bar 1738 Per Cent
Carbon	0.49	0.57	0.65	0.72	0.74
Chromium	2.75	2.90	3.08	3.84	3.00
Tungsten	16.18	15.70	16.24	18.48	16.38
Vanadium	1.13	1.07	1.08	1.31	0.99
	Treatment Temperatures in Degrees F.				
Preheat	1750	1750	1700	1700	1750
High Heat	2300	2280	2280	2330	2260
	3½ Min.	4½ Min.	4½ Min.	2½ Min.	6½ Min.

to harden all samples at a constant temperature of 2,300 deg. F., and then draw back at variable temperatures. The samples were pieces from ½ to ⅝ in. long, sawed from ⅝x1-in. bars. In hardening, all the samples from any one steel are placed in a pan and then put into a preheating furnace. The pan with the samples was later transferred to the high heat furnace, from which the samples were quenched in oil. This method of handling was used to insure identical hardening on all the samples of a particular steel. The drawing was done in liquid baths, the solutions being oil, salt or lead.

The drawing temperatures were maintained for 30 min. The hardness tests were all made on the sawed ends of the samples, so as to eliminate the effect of the bark that might have been on the surface of the bars. The ends were ground and polished, so that the Brinell impressions could be read at 50 diameters.

The results of the tests are gathered in Table II, and the curves in Figs. 1, 2 and 3 also show some of the data graphically. A curve of Rockwell versus Brinell is given in Fig. 1. If the actual points are followed a broken line results, but the straight line seems to repre-

Abstract of a paper presented before the sixth annual convention of the A.S.S.T., Boston, Mass., Sept. 22, 1924.

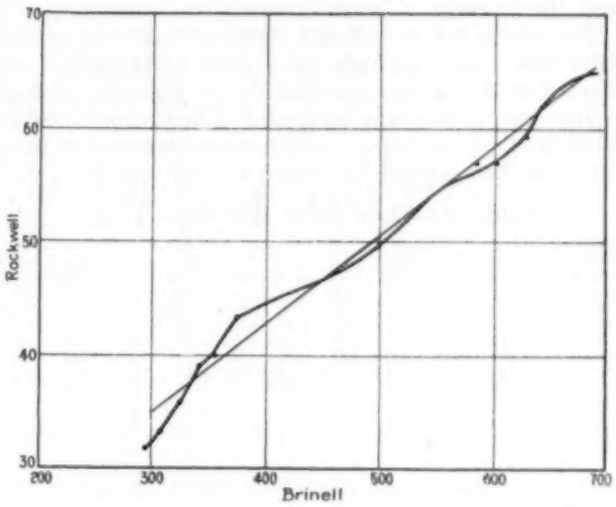


Fig. 1—Curve showing relation of Rockwell and Brinell hardness numbers

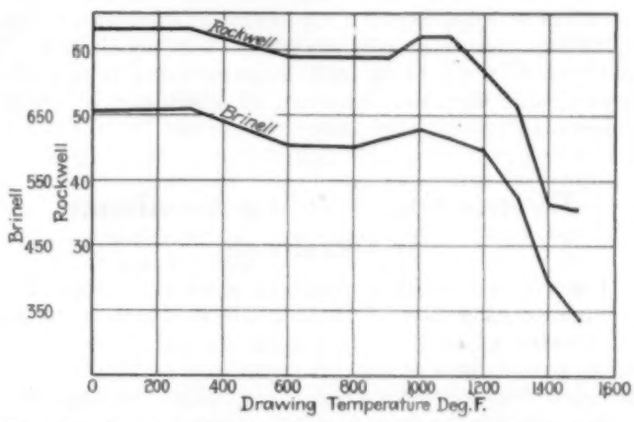


Fig. 2—Curve showing hardness of bar No. 1734 at various drawing temperatures

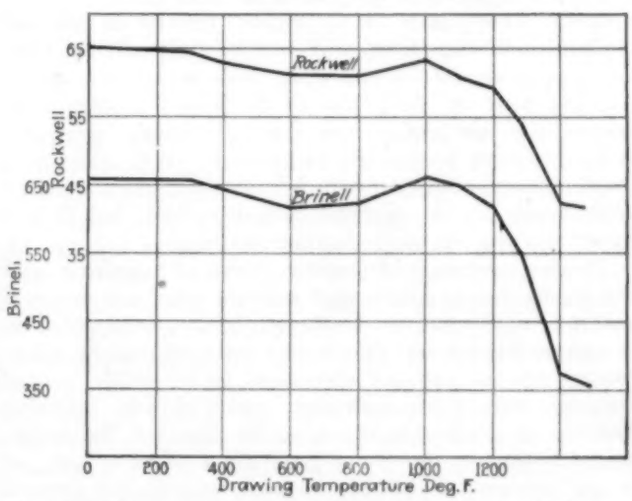


Fig. 3—Curve showing hardness of bar No. 1738 at various drawing temperatures

sent the average relation between the two methods.

The curves for Brinell and Rockwell hardness on the individual steels indicate that both instruments are affected in the same proportion by the property of steel designated by the term hardness. The Rockwell tester, while it offers, perhaps, a more convenient way of testing than the Brinell instrument, does not give any additional information regarding the hardness of the metal.

Table II—Data from Hardness Tests

Reheat Temp. deg. F.	BRINELL					ROCKWELL C SCALE				
	Bar 693	Bar 1734	Bar 1732	Bar 1742	Bar 1738	Bar 693	Bar 1734	Bar 1732	Bar 1742	Bar 1738
None.....	600	652	677	658	658	59	63	65	64	65
300.....	600	658	677	652	658	57	63	65	62	64
600.....	591	617	617	632	617	57	59	61	60	61
800.....	582	605	627	637	622	57	59	60	60	61
900.....	600	600	632	647	642	57	59	61	60	62
1,000.....	600	627	632	652	658	58	61	62	62	63
1,100.....	596	617	642	647	647	57	61	61	60	61
1,200.....	555	596	605	591	623	54	57	58	56	59
1,300.....	502	528	520	441	541	50	52	54	46	54
1,400.....	325	402	380	364	375	36	37	43	40	43
1,500.....	298	332	356	340	364	32	36	40	39	42

The maximum secondary hardness, as found by both the Rockwell and the Brinell in this investigation, occurred at 1,000 deg. F. The value of the hardness at 1,000 deg., determined by the Brinell test, equals that at no-draw in some cases, and in some cases is a trifle lower. The Rockwell hardness at 1,000 deg. F. is in every case a trifle lower than at no-draw.

Electric Spot Welding Aluminum or Duralumin

Electric spot welding has been used extensively for a number of years for uniting pieces of sheet metal by a series of separate spot welds formed in the pieces to be united by a welding current passing through the pieces. This is customarily accomplished by applying, under pressure, copper electrodes which are connected to opposite sides of a source of welding current and to the opposite faces of the pieces of steel or metal to be united. The pieces to be united furnish a greater resistance to the passage of the welding current than the copper electrodes and such resistance generates a welding heat in the pieces to be joined at the spots where the electrodes are applied under pressure. Attempts have been made to unite pieces of aluminum or aluminum alloys, of which aluminum is the major constituent, by the method just described, but it has never worked out on a commercial basis.

The writer has welded many pieces of aluminum and duralumin on standard spot welding machines without making any change whatever to transformers or mechanical parts, but this is only accomplished by interposing the superposed pieces of metal to be united between sheets of resistance material and applying welding electrodes to the opposite faces of the sheets under pressure, thereby generating a welding heat at a spot or spots in the pieces to be united, due both to the heat created in the pieces by resistance to the passage of the welding current and to the heat conducted from the sheets of resistance material to the pieces to be united. The resistance material should be of greater electrical resistance than either the pieces of metal to be united, or the electrodes, with the result that the greatest heat is generated at spots in the sheets of resistance material. It is also desirable that the resistance material should have less conductivity than the pieces to be united, so as to keep the heat generated in the resistance material localized at a spot or spots which are maintained, under pressure, in tight contact with the exposed faces of the pieces.

In spot welding sheet aluminum or duralumin I find that the best results are obtained by using steel as the resistance material and by interposing the superposed pieces of aluminum or duralumin between sheets of steel. I have also found that to obtain the best results, the thickness of the sheets of steel should vary with the thickness of the sheets or pieces of aluminum or duralumin which are to be welded together. For example, in welding two pieces of aluminum or duralumin together, each having a thickness of 0.050 in., the thickness of the sheets of steel to be used should be 0.018 to 0.020 in. When the pieces or sheets of aluminum or duralumin are united by this spot the steel sheets do not fuse whatever and can be removed very easily after the welds have been completed.

The electrodes used are preferably copper and as the sheets of steel have greater electrical resistance and less heat conductivity than either the electrodes or the aluminum or duralumin to be united, the result is the creation of localized heat spots in the sheets of steel, the heat being generated therein due to the greater electrical resistance of the steel and being largely maintained at the spots where generated, or conducted to the adjacent spots in the pieces of aluminum or duralumin due to the fact that the aluminum or duralumin is a better conductor of heat than the steel. By means of this method we have succeeded in welding commercially a metal of aluminum or an aluminum alloy without the aid of any flux or fluxes.

J. W. Meadowcroft, General superintendent of welding, E. G. Budd Mfg. Co., in the September *Journal of the American Welding Society*.

The American Engineering Standards Committee

The members of the American Engineering Standards Committee are nine national engineering societies, seven departments of the government and nineteen national associations representing most of the industries of the country. This committee is the agency which is primarily responsible for carrying standardization over to the third or national stage. Through its methods and procedure, the work of the hundreds of bodies that are in the standardization field is being broadened and unified into a truly national system.

All organizations concerned, participate in deciding whether a given piece of work shall be undertaken, in formulating the standard and in recommending its approval. The actual work of formulating the standard is in the hands of a technical committee made up of representatives of all interested bodies.

In its first four years of activity, fifty standards have been approved, and over 100 other projects have been started, 220 national bodies are officially represented on its technical committees by 1,000 individuals.

Standards that are formed in this representative way are not only more satisfactory in themselves but they are, so far as is humanly possible, safe-guarded against interference by the very fact that they represent the consensus of opinion of all concerned, changes when needed being made by a similar process.

From the booklet *Standardization*, published by the American Engineering Standards Committee.

Reducing Shop Cost in the Engineering Department

By J. A. Davis
Assistant General Superintendent, South Philadelphia Works
Westinghouse Electric & Manufacturing Co.

Reducing quantity and variety of tools and fixtures—Modifying design without detriment to product—Avoiding close tolerances where they are unnecessary

KEEN and well established competition renders it necessary for the builder of machinery to scrutinize carefully every item that enters into the cost of his product, particularly if the machine or apparatus be of a type that because of market limitations does not lend itself to quantity production.

One of the largest items of expense in the average machinery-building plant is that covering the cost of

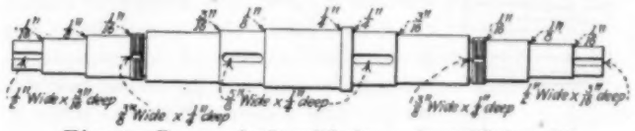


Fig. 1—Pump shaft with too many fillet radii

tools and fixtures used in the machining operations, and it should be obvious that anything that can be done to reduce the quantity and variety of such tools without embarrassing production is a step in the right direction. Nowhere in the establishment can this economy be more effectively promoted than in the engineering department. On the other hand, a more careful consideration by the shop men of almost any design will reveal opportunities to lessen the machining time, often by very simple changes in the drawing.

Generally speaking, it is the practice of most shops to accept without question the detail drawings as they are issued by the engineering department and make up necessary tools and fixtures to do the work, the quantity and quality of such tools being determined almost solely

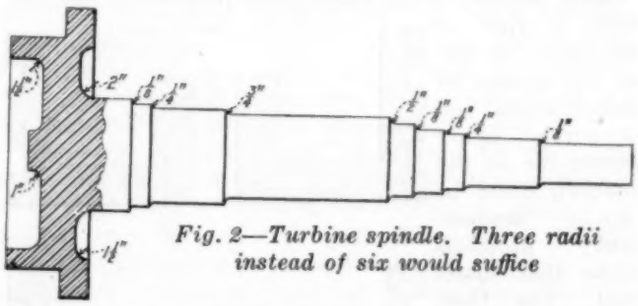


Fig. 2—Turbine spindle. Three radii instead of six would suffice

by the question of whether the piece or machine to be made is standard or special.

This acquiescent attitude of the shop is the natural result of the trend of affairs in the engineering department. Old-time shop men and mechanics of Corliss-engine days remember well when it was the practice to issue to the shops an ink-line drawing on paper, mounted on a board and varnished. Many of the parts shown on those old drawings bore only the leading dimensions—such as thickness, diameter and length. Fillets, bearing clearances, press fits and grades of finish were rarely given on the drawing, but were left to the judgment of the experienced shop men in charge of the work.

All of this has been changed and instead the shops of the present day are furnished with drawings replete to overflowing with tolerances, fits, clearances, quality of finish, fits of threads and even the sizes of tap-drills to be used. These additional details, coupled with the vast increase in production during the past twenty years, have prevented the average drawing office chief from giving as much of his individual attention to each design as would be desirable. A further handicap upon the efficiency of the designing department is the present scarcity of practical men, which is reflected in the qual-

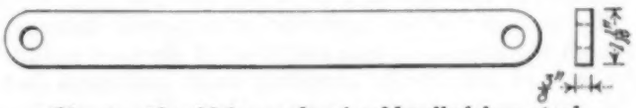


Fig. 3—Should be made of cold-rolled bar stock

ity of the designs put out and results inevitably in increased expense in the shop because of the tendency of the shop men to accept the completely-figured drawing without question and make the piece exactly to design without regard for tool or material cost.

It is the purpose of this article to point out a few of the elements of design that affect tool and shop costs, and to cite actual examples that have come under the writer's observation in which the design could have been modified, without detriment to the product, in such manner as to save money by reducing the cost of tools or the time of machining, in some instances both.

In Fig. 1 is shown a pump-shaft, the general design of which is common to many pumps. There are four *different* fillet radii on this shaft. As is well known, the object of a fillet at the shoulder made by the reduction from one diameter to a lesser one is to reduce the section of the shaft as gradually as possible in order to avoid concentration of stresses at this point. On heavily loaded shafts, notably the spindles of large turbines, the conditions justify a variety of fillet radii, but this condition does not obtain in the case under consideration, where one common radius, say ¼ in., would suffice at all shoulders.

Another thing that is open to criticism in this particular design is the difference in the cross-section of the various keyways. It is common practice in most drawing offices to have a list of standard key-sections, and to adhere strictly to that standard without regard either to the forces to be transmitted by the keys or to the fact that to make each different cross-section a different

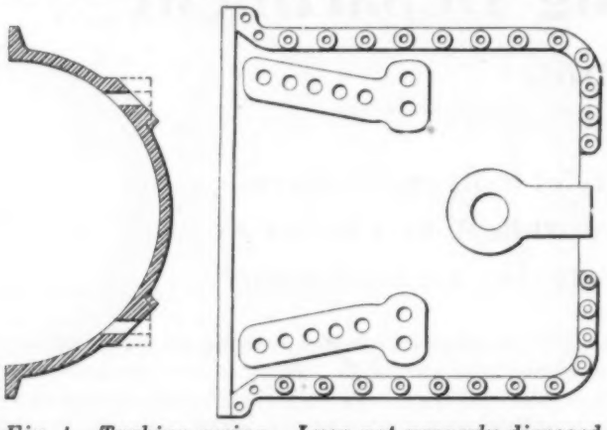


Fig. 4—Turbine casing. Lugs not properly disposed

tool is required. If all the fillets of this shaft had been made of $\frac{1}{8}$-in. radius and all keyways of $\frac{1}{2}$x$\frac{7}{16}$-in. cross-section, tool cost would have been reduced.

Another difficulty often encountered on work of this nature is that the shoulders against which couplings or pump-runners are to be forced are not wide enough. Sometimes we find that there is a difference in diameter of but $\frac{1}{8}$ in. between the part on which the coupling is to be forced and the adjoining section. As there is a fillet of $\frac{1}{16}$-in. radius at the intersection, there is really no shoulder at all. Since the bore of the coupling should have a chamfer of $\frac{1}{16}$ in. in order to insure that the coupling will not ride on the fillet, it is obvious that the shoulder is inadequate.

The operator of the hydraulic press usually keeps an eye on the pressure gage, and when it shows a sudden increase of pressure he accepts it as an indication that the coupling has reached the shoulder. If the shoulder

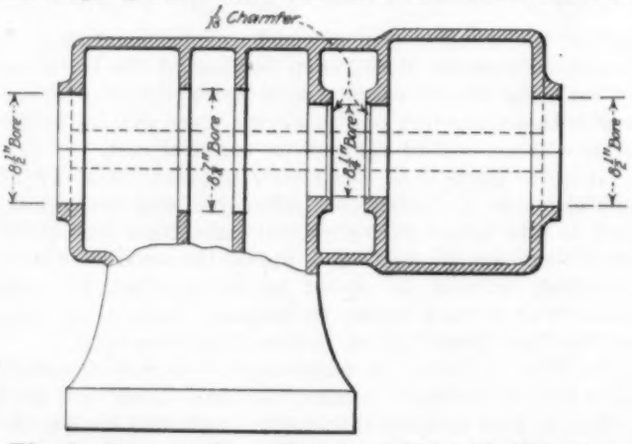


Fig. 5—Pump casing. Too many different diameters of bore

is inadequate there is a possibility of the coupling being pressed too far on the shaft. If a shoulder is really needed the designer should provide a substantial one.

In Fig. 2 is shown a shaft end for a turbine spindle. This piece is of more importance than the average shaft, but even when proper allowance is made for the fact, it would seem that three, instead of six, different fillet radii would have sufficed, and it would certainly have reduced the number of tools needed to make the piece.

The next example, Fig. 3, is a link for a valve-operating mechanism, the specified cross-section of which is 1$\frac{1}{16}$x$\frac{3}{8}$ in. If this had been 1x$\frac{3}{8}$, or 1$\frac{1}{8}$x$\frac{3}{8}$ in., it could have been made from standard cold-rolled bar stock and the milling operations necessary to finish the sides would have been eliminated. The close dimensions to which this class of material is rolled permit it to be used for a great number of parts that would otherwise require machining, and a wide variety of sections and sizes is carried in stock by the jobbers. Every designing draftsman should have a copy of the stock list for ready reference when making details of links, pins, keys and items of similar nature, the stresses upon which are such that cold-rolled steel may be used with safety.

A turbine cylinder as originally designed is shown in Fig. 4 by the full outline. The pads on the original pattern (from which several castings were made) were disposed at an angle, without regard to the cost of machining them. The dotted lines on the drawing show how the pads could be straightened up without interfering with the utility of the part and thus bring about a considerable saving in the machine shop.

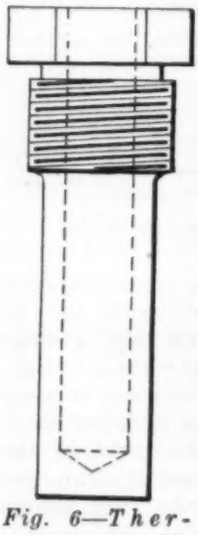


Fig. 6—Thermometer well. Made of hexagon brass bar

Where a bearing bracket or a pump casing, as shown in Fig. 5, is of such nature as to require boring with a horizontal bar, the designer should consider fully the possibilities of keeping the number of *different* diameters to be bored to its lowest possible limit. The reason for this is plain to the experienced man, as for every different size to be bored the cover of the part must be lifted in order to re-set the boring tool. Many such details have but a trifling difference in the diameters of the various bores, most of which could as well be alike if the designer would give the matter proper attention.

Another condition making for additional expense in horizontal boring-mill work is the demand for chamfers on the corners of the bores, for here, again, it is necessary to lift the cover of the part to set the tool. It should be borne in mind that I am referring to shops making limited quantities, or single pieces.

Many builders make small parts from stock castings that, in view of the great variety of the grades of rolled brass and bronze easily obtainable on the market, could be more economically produced from that material. The thermometer-well shown in Fig. 6, was made from stock castings but is now produced from hexagon bar stock.

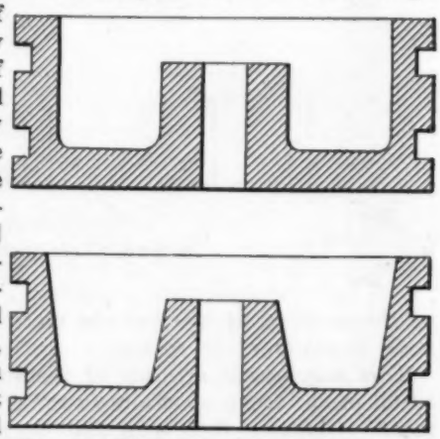


Fig. 7—Time saved in machining by changing draft

The piston shown in Fig. 7 was formerly made with heavy draft on the inside as indicated by the lower drawing. Changing this to the minimum draft necessary for molding purposes, the casting can now be chucked conveniently by the inner diameters and practically all the machining upon it done in one setting.

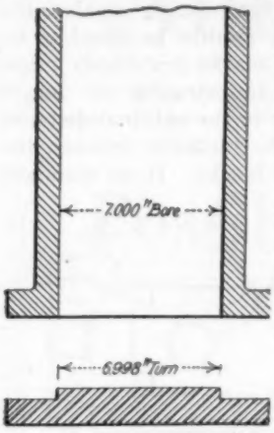


Fig. 8—Unnecessarily close tolerances

The cover of the steam cylnder, Fig. 8, is made from steel plate, and the inner surface is machined in order to provide the dowel fit in the cylinder. As this cover is literally just what its name implies, its exact position with reference to the center a matter of minor importance and the real reason for finishing the under surface solely to make a steam-tight joint, the close dimension necessary to obtain the dowel fit could have been omitted, a scale measurement substituted and a corresponding amount of time saved in the machining.

The addition of tolerances to drawings is in itself a very satisfactory procedure, but considerable care should be exercised to avoid close tolerances where they are unnecessary. The temptation in the drawing office is to go to the extreme, without thought of the expense that is involved in working to close dimensions. Particularly does this apply to large work where the difficulty of making the actual measurement with existing tools must be thoroughly understood to be appreciated.

Employee's Willful Negligence as Ground for Denying Compensation

By Leslie Childs

THE question of when, and under what circumstances, the failure of an employee to wear safety appliances will preclude a recovery under workmen's compensation statutes, for injuries received, is one of interest and importance to employers and employees in general. In some of the states, it is expressly provided that a willful and intentional failure of this kind on the part of an employee will bar a recovery of compensation. Of course, what will constitute a violation of such a provision will usually be a question of fact which must be decided in the light of all the circumstances of each particular case of the kind.

While the subject cannot be covered by the statement of a hard and fast rule, a review of a case of this kind may prove of interest and value in gaining an insight into the trend of judicial reasoning on the question. With this in mind, the recent Delaware case of Lobdell Car Wheel Company vs. Subielski, 125 Atl. 462, may be reviewed with interest and profit. The facts and circumstances which culminated in the action were, in so far as material here, as follows:

The claimant was employed to grind and chip castings, at which work he was thoroughly experienced. At the time of the accident he was working on a stationary grinder, chipping the castings by hand, with a cold chisel and hammer. While so engaged he suffered an injury which resulted in the loss of an eye.

It appears that the employer furnished goggles for the use of the claimant while engaged in this work, that he was ordered to use them at all times while at work, and that the possible danger in not using them was explained by the employer, both by signs posted at the place of employment, and at meetings held for the purpose of instructing the employees in the use of safety devices.

Upon the trial of the case before the Industrial Accident Board, the employer introduced evidence that tended to show that the claimant was not wearing goggles at the time of the accident, and that he had willfully failed to wear them. The contention was made that for this reason the claimant was not entitled to compensation. The claimant, on the other hand, contended that he was wearing goggles at the time, and insisted that the injury he received was caused by defects in the goggles.

The Industrial Accident Board did not pass on this conflicting evidence; did not decide whether or not the plaintiff was wearing goggles; or whether the goggles were defective. The board took the position that, even though the claimant was not wearing the goggles at the time of the accident, he was not guilty of willful failure to wear a safety appliance, and awarded him compensation.

The Court's Opinion

The employer prosecuted an appeal from this award to the Superior Court of Delaware. Here, in passing upon how the failure of the claimant to wear goggles, if this were found to be the case, would affect his right to compensation, the court, in part, said:

"The company furnished goggles for the protection of the employees and issued orders that the employees should wear them while working. The claimant admits that he understood this order and that they were necessary for the protection of his eyes. If he did not wear the goggles, the only explanation offered is his alleged statement that he took them off to rest his eyes, because they were heavy.* * *

"The claimant is placed in the position of refusing or failing to use a safety appliance furnished him, as ordered by his employer, the claimant understanding the order and knowing that the appliance was furnished for his protection, and also knowing the dangers accompanying a violation of the order. * * * Such facts constitute something more than negligence, and in our opinion clearly establish willful negligence on his part.* * *

"We are therefore of the opinion that the conduct of the claimant in not wearing the goggles at the time of the accident was a willful failure on his part to use a reasonable safety appliance provided for him, and that the Industrial Accident Board was in error in finding that his act did not constitute a willful one on his part.* * *"

In conclusion the court reversed the order of the Industrial Accident Board that awarded the claimant compensation, ordering the case back for a determination of the condition of the goggles, and whether or not he was wearing them at the time of the accident. Holding, as outlined in the opinion, that the failure of the claimant to wear the goggles, if this were shown to be a fact, would constitute willful negligence on his part, and preclude a recovery of compensation.

Tramming Crossheads on Running Repairs

By Clifford H. French

WHEN a locomotive is shopped for regular repairs the Santa Fé Railway uses a system of punch marks for aid in keeping the crossheads centered without running a line through the cylinder. The center line is established in the usual way and the guides set properly. Then a system of prick punch marks is established on the guides and crossheads for future use, as shown herewith.

A good prick punch mark is placed on the guides at each end as in Fig. 1, one inch from each end. Punch marks are also made on the guide blocks and on the guides either above or below as the case may be. A circle is stenciled around the prick punch mark, making a "bird's eye."

With the crosshead moved to each end of the stroke, a corresponding center punch mark is made on the end, 2 in. below the mark on the guide. These punch marks are also circled, as can be seen. Four types of crossheads are shown in Fig. 1, with the marks on each.

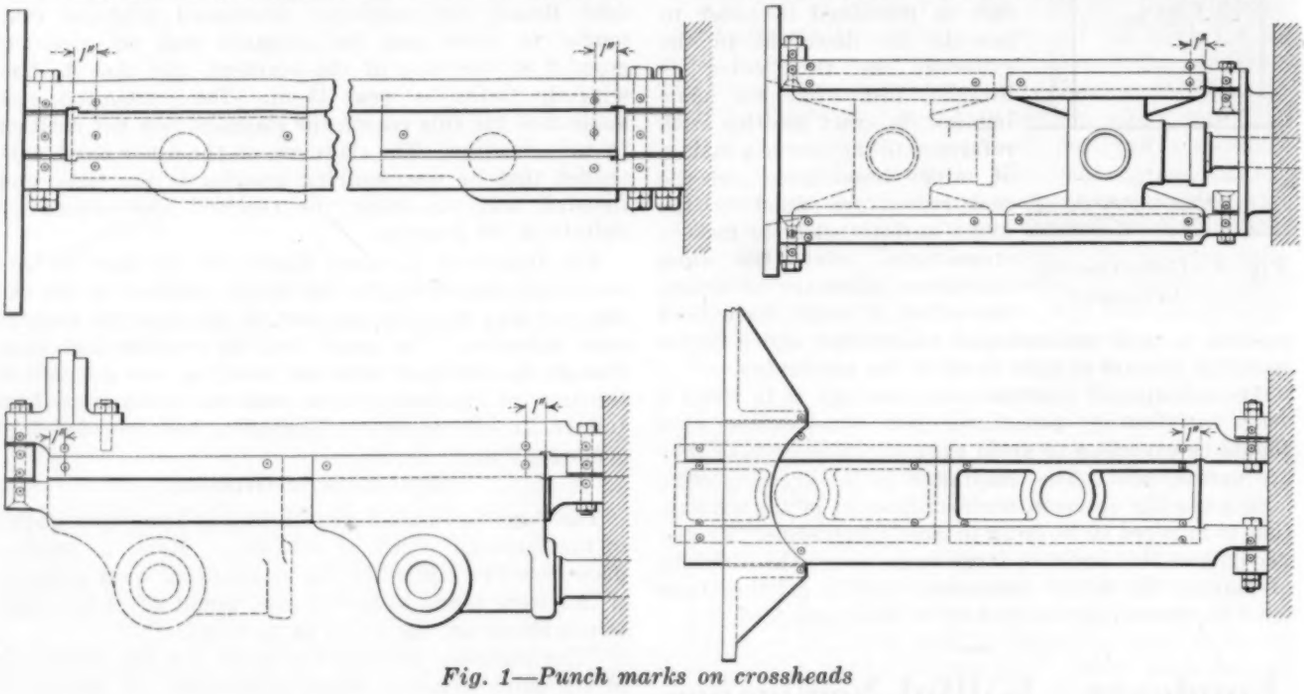


Fig. 1—Punch marks on crossheads

The centers are located with standard trams having 2 in. centers, as shown in Fig. 2. One has equal lengths scribing points, the other a long and short leg, with $\frac{3}{4}$ in. difference, to handle guides of different patterns. Both have 2-in. centers and $1\frac{1}{4}$-in. depth of throat. These trams are kept to standard with the aid of the master gages shown in Fig. 3. A gage is provided for each type of tram.

When a locomotive comes in for running repairs, the guide and crosshead wear can readily be checked by using the trams on the punch marks previously made in the shop. Repairs consist in bringing the punch marks on guides and crossheads to the original distance of 2 in. which is, of course, the distance between the marks on the guides and guide blocks. If no standard trams were available this distance could be used for centering the crosshead, using dividers or making a tram for the purpose.

Suppose the top crosshead shoe has worn $\frac{1}{8}$ in. and the bottom shoe $\frac{1}{16}$ in. Then the distance between the marks on the stroke portion of the guide and crosshead will measure $2\frac{1}{16}$ in. and the bottom will measure $1\frac{13}{16}$ in. To locate the crosshead in the center, the ends of the bottom guides must be reduced $\frac{1}{16}$ in. and the top guide $\frac{1}{8}$ in. This will lower the top guide $\frac{1}{8}$ in. and raise the lower guide $\frac{1}{16}$ inch.

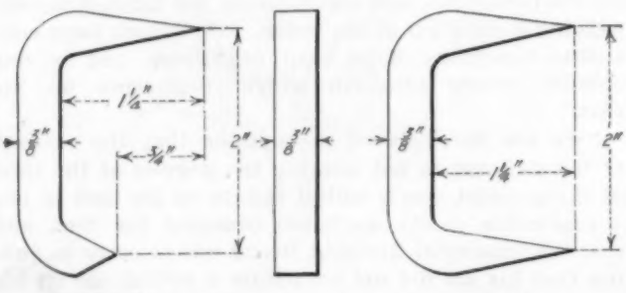


Fig. 2—Two types of trams used

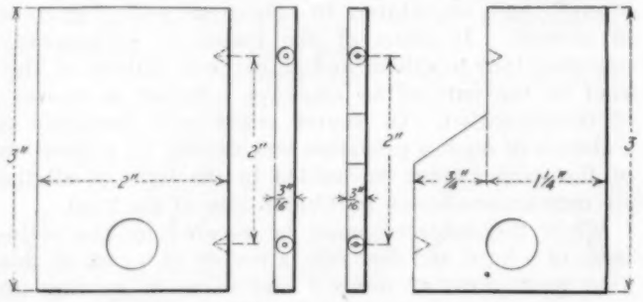


Fig. 3—Master gages for trams

The distance between the punch marks on the ends of the guides and the guide blocks will be changed by this procedure. So the punch mark on the guide is peened out and a new one located at the proper place to be ready for future lining up of the crosshead. This method has proved to be a great time saver in the shop.

Automotive Production

Possible Economies in Automotive Machine-Shop Operations

By A. L. DeLeeuw
Consulting Engineer, New York City

Use of accessories such as feeding and chucking devices and conveyors—Development of special machines—Milling and grinding, milling cutters and grinding wheels

IN THE foregoing it was assumed that a very simple and constant ratio exists between the loading and the drilling times, and that these times were the same for all four machines. In practice it will be found that a certain unavoidable variation occurs in the loading time and that it is exceedingly difficult to have at all times four jobs for four machines, all of which have the same loading and drilling time. As a consequence, the figures given above must be modified. It is highly probable that on an average run of work only a fraction of the final economy can be attained. Nevertheless, it is almost always possible to group simple operations to obtain at least a part of the ideal reduction in cost.

When such a grouping of machinery is resorted to it is highly desirable to place the machines so that the minimum amount of walking will be necessary in serving them all. Whenever possible the machines should be grouped around the man and not in a straight line. When the nature of the product is such that the same group of machines can work on the same product all the time, a permanent location of such a group of machines is desirable. But when the work is shifted, it would be advisable to have the machines so arranged that they can be easily relocated. This, of course, requires motor-driven machinery that can be lifted with a crane and placed in position at any time. This method is followed nowadays in a few factories where conditions allow it.

Ingenuity in Grouping Work

A certain amount of ingenuity is required to group the work in the way to obtain the greatest possible economy, but this ingenuity is of no higher order than that which must be displayed by a dispatcher of railroad trains. It is seldom that jobs are so related as to the quantity and the time required for operation that a perfect combination can be effected. For instance, when 100 pieces require 30 sec. for an operation and 50 other pieces require a full minute the combination is perfect; but if 100 pieces require a full minute, and 50 other pieces require 30 sec. a piece, the combination is defective; but this does not mean that some grouping is not possible. The fact that an ideal is not obtainable should not deter us from aiming at it and hitting near as possible. The labor required to plan such grouping and arranging of work is the chief source of the expense to which reference has been made.

Much more could be said about the things that can be done to reduce costs by careful planning. But, as all that can be said in this paper must necessarily refer to imaginary figures, I believe that sufficient indication has been given of the possibility of effecting economy without capital outlay. The next class of improvement to be considered is that requiring some capital outlay for jigs, fixtures and other accessories for the work of drilling.

Accessories for Drilling Work

Among these accessories may be mentioned indexing-tables, semi-automatic fixtures, special devices for lubrication, and the like.

Indexing-tables are particularly useful when the work of loading is greater than that of drilling. Such devices apply, therefore, especially to multiple-spindle drills and, more especially yet, when the work to be drilled is large and cumbersome to handle. When such a machine is used it will be found that the machine cost is high and that the machine is idle a large percentage of the time. If, for instance, the actual work of drilling is done in 2 min. and it takes 3 min. to remove a piece and load another one, we have the following set of conditions: The machine cost per year will be 15 per cent of $5,000, or $750; the labor cost will be $1,500; and the total cost will be $2,250. The machine is occupied 2/5 of the total time.

If now a special fixture or indexing-table is furnished and two men are used for loading, so as to bring the loading time within the machining time, the same

Conclusion of a paper read at the Production meeting of the Society of Automotive Engineers, Detroit, Oct. 22. The first part of the article appeared in the preceding issue.

AUTOMOTIVE PRODUCTION

amount of work will be done in 2/5 of a year; so that the machine cost for the same amount of production will be 2/5 of $750, or $300. The labor cost in this case will be 4/5 of $1,500, or $1,250, and the total cost, $1,200 plus $300, will be $1,500. This is a saving of $750. An indexing-table would be an asset. On the other hand, a double-swinging fixture could not be considered as a permanent asset and should be written off as expense. This expense should be covered by the gains in one, two, or possibly more years.

If the time of loading should happen to be about the same as that of drilling, then we should have the following set of conditions: Using a single fixture and one man, the cost per year again will be $2,250, and the machine will be occupied ½ the time. Using a special fixture or indexing-table, the same amount of production would be obtained in ½ year; in which case the machine cost would be $375 and, as only one man is now employed, the labor cost will be $750 or a total of $1,125. Whether this arrangement or the previous one should be used will depend on whether it is possible for one man to load the fixture in 2 min., or a helper would be required. The examples given are merely illustrative. It will be seen that an analysis of each individual case will be required before a decision can be made.

Automatic Stock-Feeding Devices

A class of device that can be applied to drilling-machines, and for that matter to other machines, as well, includes the automatic stock-feeding devices, such as hopper feeds, magazine feeds, dial feeds, and the like. There is good ground for a difference of opinion whether such devices should be classed among accessories or among permanent additions to the machine. It is sometimes one, sometimes the other.

Except in a very few cases the hopper feed finds no place in the automotive industry. Hopper feeds are economical when large numbers of pieces must be machined year in and year out; these devices are "at home" in large-quantity manufacturing. The difference between a hopper feed and a well-developed magazine-feed is that, in the first case, the material is dumped into the hopper without regard for the position it takes, and depends on the hopper to rectify its position and bring it to the machine in the proper manner. In the case of magazine or dial feeds, the material is placed in position, not necessarily in the position that it must have in the machine, but in some definite position, depending on the construction of the magazine. Consequently, the economic difference between these two classes of device is merely that the operator spends less time in supplying material to one machine than to the other and, unless such a machine can be kept on one operation continually, unless a hopper can contain a large number of pieces at one time, unless the hopper is not liable to cause trouble, and unless such a hopper device can be developed at moderate cost, no economic reason exists for employing such a device at all. Notwithstanding the best skill of the designer, a hopper device almost always requires some experimental development to eliminate what the shopman calls "the bugs." For this reason alone it is doubtful whether hopper devices are of any economic importance in the automotive industry, except for some standardized articles, and these, as a rule, may be bought outside. Among articles of this kind, ordinary nuts, castellated nuts and the like may be mentioned.

Magazine and Dial Feeds

Magazine and dial feeds are devices belonging to the same class. Both are magazine feeds. The particular kind of magazine feed to be used for any one piece depends on the nature of the piece, the work to be done, the machine on which it is to be done. In a dial feed the pieces are placed, as a rule, in such positions that they are presented to the machine ready for the operation. The pieces may be held by a device operated by the workman or by the movements of the machine itself. In a magazine feed, as distinguished from the dial feed, pieces are not arranged or held in this manner, and additional parts must be provided to fasten the piece in the proper position. In the automotive industry, a great many pieces are suitable for such magazine or dial feeds, but whether the devices should be applied must always depend on an analysis of the economic conditions. The life of the piece, that is, the number of years during which it may be expected to be used, the cost of the device, the saving in labor cost, and the like, must all be considered. Such points can only be indicated in this paper.

Drilling-machines lend themselves particularly well to the application of such devices but, on the other hand, the saving to be accomplished is not quite so great as it may be in other types of machine. It stands to reason that the greater the cost of the original machine and the greater the amount of floor space that it occupies, the more inviting will be the application of such a device.

Chucking Devices

Another class of device that may be employed either alone or in combination with magazine feeds is the pneumatic or hydraulic chucking-device. As a whole, it may be said that these devices are not employed as much as they deserve. One reason that pneumatic devices are looked upon with some distrust is that the pressure in the air-line may vary to such an extent that the chucking will become uncertain. This is not a defect of the pneumatic devices themselves, however, but is caused by the fact that they are operated from the main air-line, which is used for such a variety of purposes and in so irregular a manner that an uneven pressure results. The proper manner of applying pneumatic devices is to have a smaller compressor for each machine or, better, for a group of machines. When this is done it will be found that the air pressure is sufficiently constant to allow the use of air-chucks without appreciable trouble. When hydraulic devices are used an accumulator should be installed to provide constant pressure. Such hydraulic devices do not cause trouble, because the pressure can be kept low. They allow smaller cylinders to be used because, even though the hydraulic pressure may be low, it may be considerably higher than would be practicable for a compressed-air line. On the other hand, the question of drainage must be considered and may at times be sufficiently serious to condemn an hydraulic installation.

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The hydraulic or pneumatic chucking-device will be found particularly useful with magazine or dial feeds.

Dial feeds are most commonly used for small presswork, but one of the reasons that the pressman hesitates to install such a feed is the difficulty of obtaining the proper relation between the dial feed and the die. In such cases this difficulty may often be overcome by lifting the piece out of the dial and placing it in the die by means of suction. I have used this system for various purposes and have found it to be reliable and successful. A single vacuum-pump may be used for several machines. Not only presswork but polishing and buffing can be expedited in this manner.

Conveyors

In drilling, reaming and tapping some of the larger pieces, various devices are used to facilitate transferring them from one machine to another; principal among these are conveyors and the track-and-trolley system. The same principles apply to small pieces on which various operations have to be performed. In some shops gravity-conveyors lead from one machine to another but, after all, these are merely a means of handling the pieces between operations, each operation being performed by different workmen. This general scheme may be modified when machines with automatic feed are used. These machines may be grouped so that the spindles are spaced at regular distances apart and a conveyor may be used to move the pieces automatically from one spindle to another, when the spindles have returned to their starting-points. A conveyor must have definite locating-points, and a workman is supposed to place the work at these points. Another possibility is that the conveyor may merely pull the pieces from one position to another and locate them approximately, while a fixture at each machine locates the piece definitely by means of some auxiliary chucking-device, such as an air-piston or a cam-lever.

Many of the last-mentioned devices call for machinery that is more or less automatic in its action. In this connection, it should be pointed out that a large quantity of machinery in use at the present time does not possess these automatic features. I have noticed that a great many sensitive drills, hand tapping-machines and even lever-feed drill-presses are still in use in the automotive industry. This leads to the consideration of the third class of improvement, namely, the devices and processes that require an initial capital outlay. I wish to point out that although drilling and affiliated operations have been used as examples pointing toward different means of improvement, these remarks are, to a large extent, also applicable to other operations.

The Sensitive Drill

The simple sensitive drill has very little place in the automotive industry. It is peculiarly effective when very small holes can be drilled only with difficulty and a power feed cannot be used with safety. It is differentiated from the lever-feed drill-press merely by the fact that a short lever, instead of a long one, is employed, so that it is not possible to apply heavy pressure to the drill. Even at that, such a machine is not sensitive unless the operator makes it so. For ordinary manufacturing operations the sensitive drill-press and the lever-feed drill-press are of the same type.

It is often maintained that the lever-feed drill-press is particularly effective for operations that do not require a very accurate hole, because the workman, especially if he is working on piecework, will, using shop parlance, "punch the hole through." This assertion has very little truth because there is no reason why a power-feed drill-press cannot give the same feed as the hand. Furthermore, a hand feed is necessarily irregular, and the drill suffers in proportion to the maximum pressure put on it. With power feed, this pressure is always the same and can be limited to what is correct for both the drill and the work. Taking it all in all, then, it may be said that neither the sensitive drill nor the lever-feed drill should be used in the automotive industry, a few cases only being excepted.

Machines are now in the market that allow the operator to be engaged constantly in loading pieces while the machine does the drilling. Such a machine has, of course, a number of spindles, some or all of which may be used according to the relation existing between the time of loading and the time of drilling. If such a machine has six spindles and it takes 5 sec. to load and 15 sec. to drill, no benefit is to be derived from using more than four of them; but if the time of loading is 5 sec. and the time of drilling 25 sec., all six spindles can be used to advantage. Here again the controlling principle is to keep both the man and the machine occupied all the time.

Machine Different Pieces in Multiple Machine

These machines need not be used on a single piece. The quantity of a single piece may not be sufficient to justify the machine's being set up for one piece only, especially if special fixtures must be made, because a six-spindle machine would require six fixtures whereas the amount of work might justify only one. But there is no reason that such a machine cannot be set up for several different pieces at one time. One piece may require a single fixture, another two fixtures, and so on. As has been pointed out, it may be difficult at times to group the work so as to have both machine and operator work all the time but, with some exercise of judgment, it will be found possible at all times to group a sufficient quantity of work so as to get at least a large percentage of the maximum benefits.

A wide field exists for the use of multiple-spindle tapping-machines, properly arranged gang-drills, and what might be called combination machines, machines that will do drilling, reaming, facing, tapping and the like in the same way that a mutliple-spindle automatic screw-machine performs its operations.

The automotive industry has not yet been sufficiently standardized to make the development of special machines entirely safe. On the other hand, most of the ordinary standard machine tools may be called overdeveloped for this industry. Wide range of feeds and speeds, universal adjustments, and the fact that they allow a wide variation in the dimensions of the work make them suitable for jobbing work, but too complicated and, consequently, too expensive for what is required of them in the automotive industry. It is seldom

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that a machine must be changed over from one piece of work to another; consequently, the total amount of time spent on the machine during a year in arranging it for new pieces of work is but a small percentage of the entire year's performance. Quick adjustment and change from one feed or speed to another are essential in machines for jobbing work but are of little importance in the automobile shop. A few of the simpler machines are now in the market. Machines that have recently been developed for automobile work have usually been constructed along simple lines. This tendency should be encouraged.

To recapitulate what has been said about possible improvements in drilling practice: More attention should be given to the proper selecting and sharpening of tools, to the grouping of operations, and to the planning with a view to keeping both the man and the machine employed all the time. Wherever economical, indexing-tables, conveyors and the like, should be used. The use of sensitive drills and lever-feed drills should be stopped; and, as a whole, the question whether single-spindle or multiple-spindle machines should be used ought to be studied in every case. It should be kept in mind that even when conditions do not justify an expensive multiple-spindle machine, multiple-spindle heads may be used to advantage. Automatic chucking-devices and magazine feeds should be employed to the largest possible extent.

To survey all the possibilities for improved production in an industry as large as the automotive industry is entirely beyond the scope of this paper. The writer has selected machine-shop operations, not because they are the most important ones, but because they are of a more uniform nature and allow more definite discussion. Even with this limitation, the subject is entirely too large for this paper, and for this reason the writer has confined himself until now to a few high points of a single class of operation.

Application of Principles to Milling

Most of the remarks made apply to other operations as well. To take, for example, milling operations, here again great benefits may be derived from a careful selection of cutters and their proper sharpening. The lack of uniformity of cutter practice in a single shop is rather surprising. Though I am fully aware that local reasons may account for such a lack of uniformity, I do not believe that as a rule these reasons are of sufficient importance to govern the output of so important a department as the milling department. In this connection likewise it has been my experience that cutters of different makes differ greatly, and that it would pay well to investigate carefully which cutter will give the greatest output per dollar invested. Simple rules, such as the use of the smallest possible cutter compatible with an arbor of sufficient strength, are rarely followed in the average shop.

I have seen fixtures so arranged that the cut has a tendency to pull the work up, whereas it might have been arranged just as easily to bring it down. A striking instance of this lack of detail study was presented by three duplex-millers, all working on the same operation and on the same piece. In the first machine, both cutters were running in a direction that pulled the work up; in the second machine, both were working in a direction that pushed the work down; and in the third machine, one cutter pulled up while the other pushed down.

Not only was a wide variation found in the practice of different shops, but even in the milling practice of a single shop, and even within a single department.

It is not my intention to criticize the conditions that have been mentioned, but rather to point out opportunities for increasing the output and lowering the cost without capital outlay and without rearranging departments, merely by carefully studying the conditions. That the necessary ability or even manpower, may not be available for making such studies is neither here nor there. The point is that opportunities for reducing cost occur and should be grasped whenever possible.

End-Mills and Gang-Mills

Among the things that can be done to cheapen production, without requiring a material outlay of money or a change of equipment, are the more extensive use of end-mills, the use of gang-mills, especially arranged for some definite operation and kept for that purpose only, and the aplication of stream lubrication. The last-mentioned item is very productive when it can be applied. That it cannot be applied to cast-iron work, and is not easily applied to end-mills or to face-mills, is not a good reason for not applying it at all. The only equipment required for stream lubrication, in addition to the regular equipment, is a centrifugal pump or, generally speaking, some source of supply of a large amount of lubricant or coolant under low pressure, a guard around the table of the milling-machine, and some means for draining off the liquid. In addition, a shield closely enveloping the cutter must be provided. As against these small items of expense may be mentioned the fact that in many cases the speed of the cutter can be doubled, tripled, and sometimes even decupled, over that which would be possible in ordinary practice. It allows the rapid production of pieces that on account of their frailty, or the impossibility of holding them rigidly, do not allow a heavy feed.

Among the methods of milling that should be employed to a much larger extent than they are employed at present, are continuous milling with the help of a rotating table, either on a vertical or on a horizontal machine, the use of loading-fixtures, and semi-automatic and automatic milling.

As to the needs of the automotive industry for new types of machines, I would mention very small semi-automatic millers, for light cuts on the smaller pieces, and multiple-spindle milling-machines. The first-mentioned class finds only limited application but is profitable when it can be used. I am drawing on my own experience in making this statement. The second class, multiple-spindle millers, is not at present in existence as standard tools, and might be too expensive if purchased as special tools. But, just as in many cases a multiple-spindle drilling-head will serve in the place of a multiple-spindle drilling-machine, a multiple-spindle milling-head attached to a standard machine can replace the special multiple-spindle miller.

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All the things mentioned with regard to milling can be found when visiting automotive shops, but they are at present rather the exception than the rule. Furthermore, to the extent that a study has been made of the requirements of milling, it has been applied mostly to the more important operations on the main pieces of the automobile, whereas progress along these lines has been slow for the less important operations and pieces. Nevertheless, taken as a whole, the less important operations and pieces require a large number of men and a great deal of equipment, and fully deserve the most careful attention.

Improvements Require Changes in Machine

Grinding operations do not lend themselves well to worthwhile improvements without making some change in the existing machine. This might be expected because the operator has no control over the tool. There is no way by which he can sharpen the tool to a preferred angle; nor can he improve on the lubrication or on the holding devices for tools or work except, perhaps, in the rarest instances. He may find that a certain material gives the best results with his grinding wheel but he will always be left more or less in the dark as to the hardness, for no two wheels are exactly the same.

On the other hand, grinding operations lend themselves probably to greater improvements than do any of the simple cutting operations. To mention one thing, I have found by actual test that a small difference in the wheel speed makes an enormous difference in the wear of the wheel. It was found that a carborundum wheel running at 5,700 ft. per min. would remove 1.9 cu.in. of cast iron, when grinding cast-iron bushings, with 0.001 in. loss in diameter; whereas the same wheel, when running at a surface speed of 6,000 ft. per min., would remove 5.7 cu.in. of cast iron. This little difference of 300 ft. per min. increased the output of the wheel exactly 200 per cent. Knowledge of these facts made it possible to prescribe a fixed number of passes over a given piece of work and made measuring with the micrometer unnecessary, except for an occasional test-piece. It was further found that to increase the speed 300 ft. on the other side of the 6,000-ft. line caused the wheel to glaze and reduced the output. There was, then, a critical point in the speed of the wheel. Though it was found that the actual speed of the wheel should be very close to this critical point, it was also found that existing grinding-machines do not have the means of obtaining any desired speed; but this was overcome by driving the grinders by adjustable-speed motors and by providing the necessary safeguards, so that a workman could not run the wheel at a dangerous speed, when replacing a worn, small wheel with a new, large one.

Though I do not wish to say that the difference in the performance of a wheel is always as great as it was found to be by the test mentioned, experience has shown that there is always a critical point for the speed of the wheel, and that the best results with regard to uniformity of dimensions and lasting qualities of the wheel are obtained at or near this critical point. If advantage is to be taken of this condition, means must be provided for running a grinder at whatever speed may be necessary to produce the critical speed of the wheel used.

Wide-face wheels are probably used to a larger extent in automotive shops than in those of any other industry, but this is not saying very much, because as a whole the merits and the practicability of wide-wheel grinding are not very well known. Wheels up to 8 in. in width have been successfully used, and to the best of my knowledge no reason exists that wider wheels should not be used, provided that they can be adequately supported. I have used stepped wheels and was able to control conditions without trouble. It seems that the use of wide wheels in grinding practice should be largely extended.

Grinding lends itself very well to the use of magazine feed. So far, magazine feeds have been confined mainly to centerless grinders, but in other industries automatic grinding-machines with magazine feed, using wide wheels, have been developed and are used very successfully. If possible, the wheel should be given a slight shaking-motion in the axial direction, when the end of the cross-feed or the in-feed has been reached. It is possible, however, to produce a good job without this end-motion, when shoulder work must be done and axial shake is not possible.

Cylinders Ground One at a Time

No apparent reason seems to exist that not more than one cylinder should be ground at one time, except that, at the present at least, no machine can perform this operation. At the present time opinion differs so greatly as to the best way of finishing cylinders that a drive for a multiple-spindle grinding-machine might not be justified. In connection with the different ways of finishing, I wish to state that I have succeeded in producing a very accurate size and a very hard and glossy surface in cast-iron bushings by running through the bushing a piece of hardened steel resembling somewhat a straight-fluted reamer with gentle taper, but having the ribs rounded instead of presenting cutting edges. About 0.0006 in. per inch of diameter was allowed for reduction. A similar method might be successful in finishing cylinders, though I do not wish to go on record as saying that it is bound to be successful. The lack of uniformity of cross-section in a cylinder might produce undesirable results. This method, furthermore, can be employed only when the cylinder to be burnished is open at both ends.

As has been said before, the scope of this paper does not allow me to go into all the operations that are common in the automobile factory, nor into detail regarding any one of them. I have aimed to give sufficient examples of a few operations to make it clear that substantial improvements can be made and that, at the present time at least, efforts in the direction of economy should be directed toward the small pieces and small operations, because these happen to be the field that has been least cultivated. This is a condition not at all peculiar to the automotive industry; it can be found in almost any shop. As it is much easier for the average man to recognize unsatisfactory conditions outside his home than inside, an illustration with regard to a shop that is not an automobile factory may not be out of place here.

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On a recent visit to this factory, which is well known throughout this country for its high-grade work and up-to-date methods, I found that many of the chief operations, particularly on the larger pieces, were excellently taken care of. Operations that presented great difficulty had been studied thoroughly and the difficulties had been overcome in a most ingenious and satisfactory manner. On the other hand, in one department alone, 125 operators were found, all drilling small holes in small pieces with sensitive drills. Apparently the operation was too insignificant to attract the attention of the engineering department.

It is my opinion that, to a certain extent at least, the same condition prevails in the automotive industry, and that greater gains can be made in the field of small operations with less capital outlay than in the activities of other parts of the shop.

Abstracts

from other publications

Bus Unit Overhauls

Maintenance methods as practiced by the Wisconsin Motor Bus Co. are such that during the four-day period including a Fourth of July not one road failure was experienced, with 100 buses in service. Maintenance work is expedited by the work of jigs, work stands, test racks, benches and specialized tools. On the second floor of its garage, 55x200 ft., are the tools and facilities for complete rebuilding.

The bus to be overhauled is taken to the second floor by an elevator. It is driven to the forward end of the floor, and the principal units are removed. The engine, the transmission, the radiator, the rear end, and the battery are replaced by previously overhauled units. In this way the time that the bus is held in for overhauling is reduced to a minimum. While this replacement work is similar in many respects to that practiced by other operators, it is the overhauling work on a unit that has received particular attention, in order to simplify and speed up the work. The company at the present time has four different makes of buses, namely, Whites, Fageols, Fifth Avenue, and Yellow, and of these makes, three have two or more models. In designing the special tools it was necessary to provide for the several sizes and types of all units represented.

The engine stand is so constructed that any of the engines may be held in any intermediate position for work on cylinders or crank case and as the parts are taken off they are placed in compartments of a removable work bench kept on hand. This bench is of heavy wood construction and is mounted on swivel double casters at the four corners. The base is made of 1-in. oak and is 5 ft. long and 2 ft. wide. Two corner posts and two upright panels support the bench and compartments of the upper tray, which is located about 36 in. above the floor. The upper part, that is, the work bench and its support, is 2-in. oak, to provide a solid foundation for bench work. There are four compartments between the upright panels into which the four pistons with their connecting rods and caps are placed. Attached to the outside of one of the panels are two metal trays divided into four compartments each. These hold the various small parts identified with the four cylinders of the engine. The bench has been provided with a small hand vise. Dissembling of some of the smaller units of the engine is accomplished on this bench through the aid of the vise.

After the necessary machine and replacement work on the parts of the engine, they are transported back to the assembly rack. The machine work usually consists of re-boring cylinders, fitting pistons and rings, fitting piston pins, grinding and aligning crankshaft, fittings new cranksshaft and connecting-rod bearings, and other major repairs. After the engine is mounted on the assembly rack, but before the pistons and crankshaft are in place, the three main bearings are reamed by a line reamer.

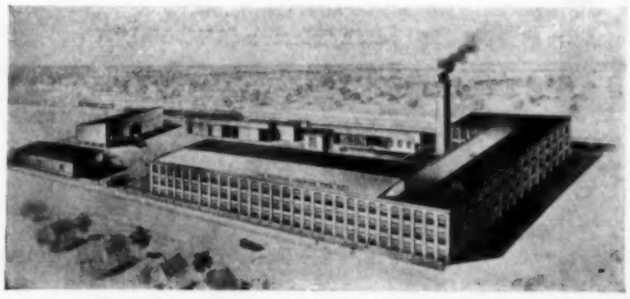
Many illustrations are given and a similar description is given for the handling of transmission and axles.—*Bus Transportation*, Oct., p. 452.

Regrinding Cylinders

Cylinder regrinding offers an excellent example of how abrasive engineering has been instrumental in the development of entirely new branches of industry. Ten years ago the process was almost entirely unknown, today it is almost the only one, and there are 1,600 regrinding plants scattered throughout the country. One of these is described in this article and some of the work is taken up. For example, in actually boring a cylinder it states that if the holes have been subjected to natural wear only, the block is reground immediately. However, if deep scores are in evidence it is necessary to fill them by electric welding before regrinding. The object of this is obvious for an undue amount of metal would be removed from the cylinder walls in eliminating deep scores by grinding. In some instances scores of $\frac{1}{32}$ in to $\frac{1}{4}$ in. depth are encountered caused by loose wrist pins cutting the cylinder walls. Slight scores not over a few thousandths of an inch can be removed in the regrinding operation. The block is mounted on an angle-iron fixture on a cylinder grinding machine equipped with a carbide of silicon wheel, $1\frac{1}{4}$-in. face, 40 grit and of suitable diameter. The wheel is operated at a peripheral travel of 5,500 ft. per minute, while the planetary motion of the spindle is approximately from 60 to 180 r.p.m. The work advances at any of three speeds depending upon the cut and hole. Normally it is $\frac{1}{8}$ in. for each planetary revolution of the wheel. As the two movements of the wheel are rigidly controlled, the wheel face cuts a true circular path regardless of hard or soft spots, using the base of the cylinder block as a locating point, the wheel generates a round and true bore. As the wheel is supported rigidly it does not sink into depressions in the cylinder wall caused by excessive piston wear as does a boring tool and when a hard spot is encountered in the metal the wheel does not spring away from it.

Similarly the regrinding of pistons, and crankshafts is taken up though in a smaller extent.—*Abrasive Industries*, Oct., p. 241.

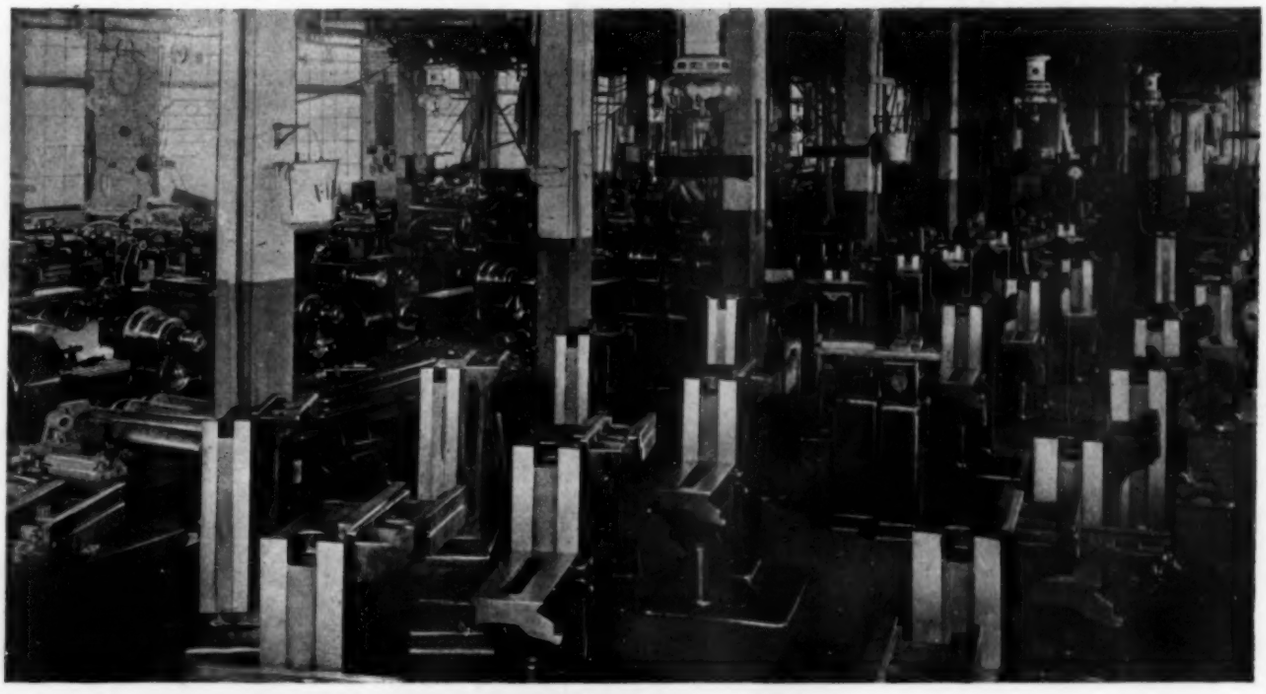
Where Machine Tools Are Made

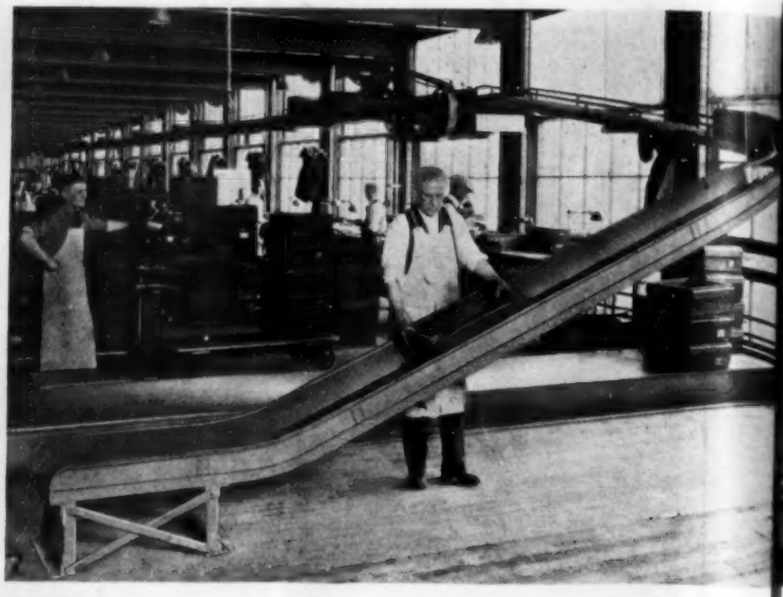


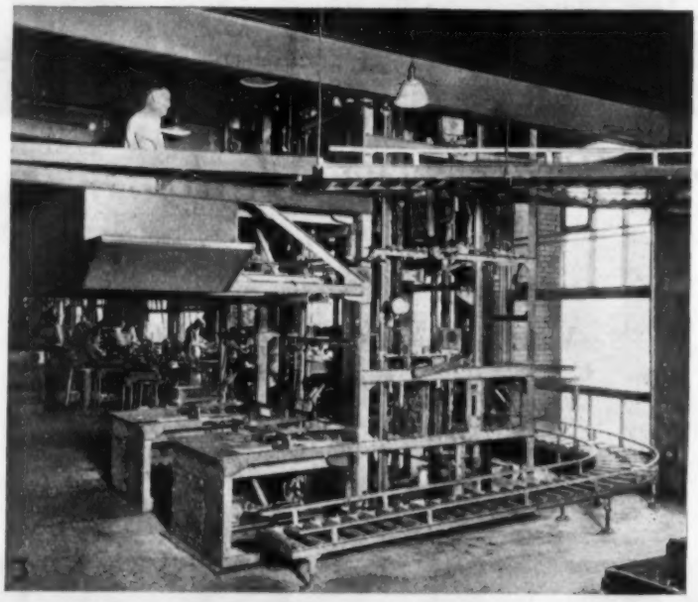
Van Norman Machine Tool Company

Springfield, Mass.

Established 1888







Modern Methods of

Cash Registers

(National)

Fig. 1—Rollers in inspection room

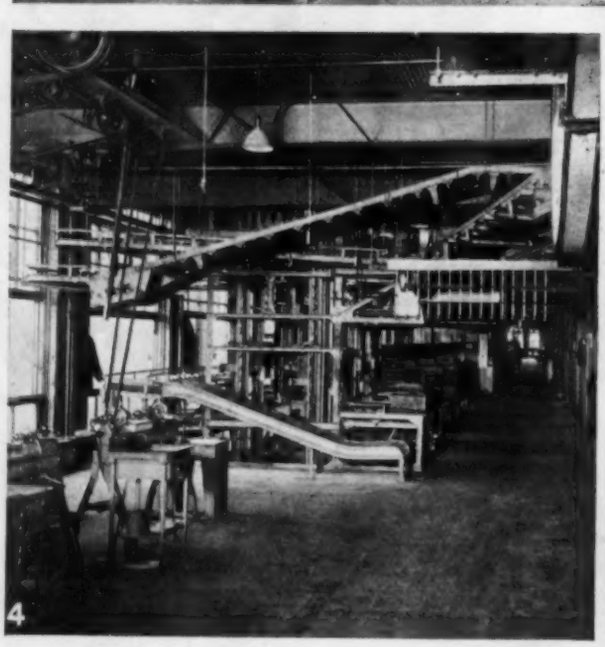
Fig. 2—Delivery boxes for trucks

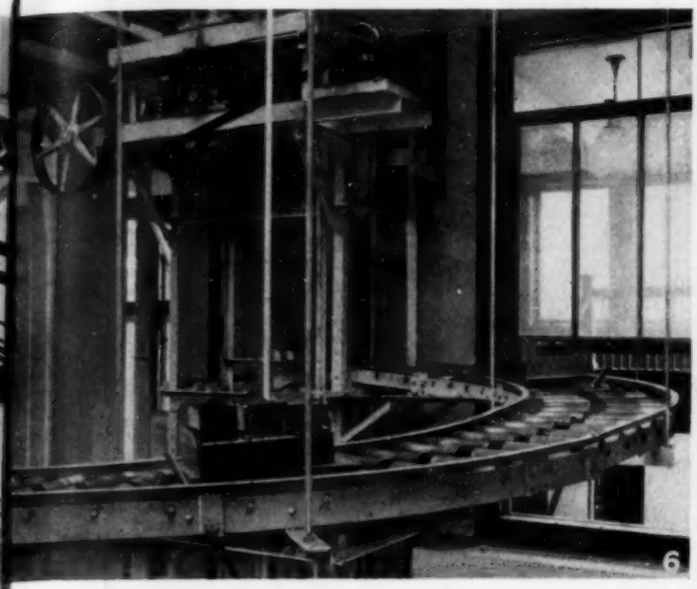
Fig. 3—Dispatcher at elevator

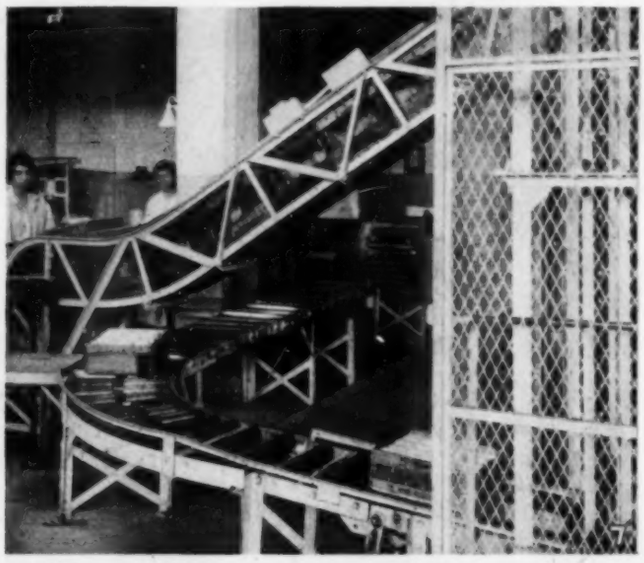
Fig. 4—Elevator, belt and chute

Fig. 5—Belt, elevator and delivery chute

Photographs by courtesy The L







ods of Conveying Work

Yeast Cakes

(Fleischman)

Fig. 6—Automatic unloading to conveyor

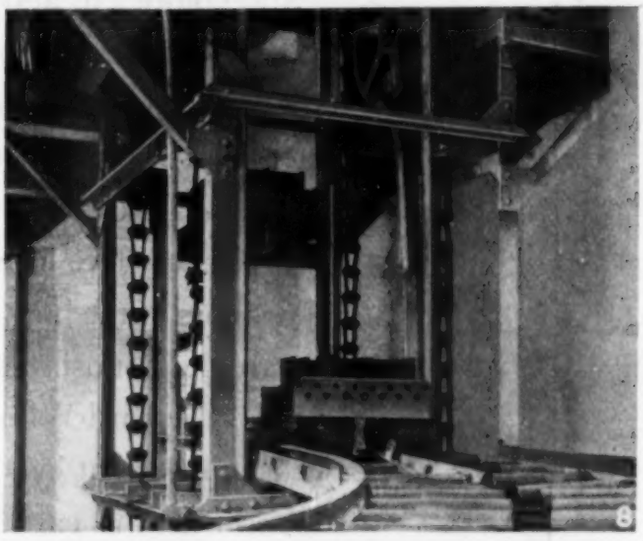
Fig. 7—Gravity conveyors and loading station

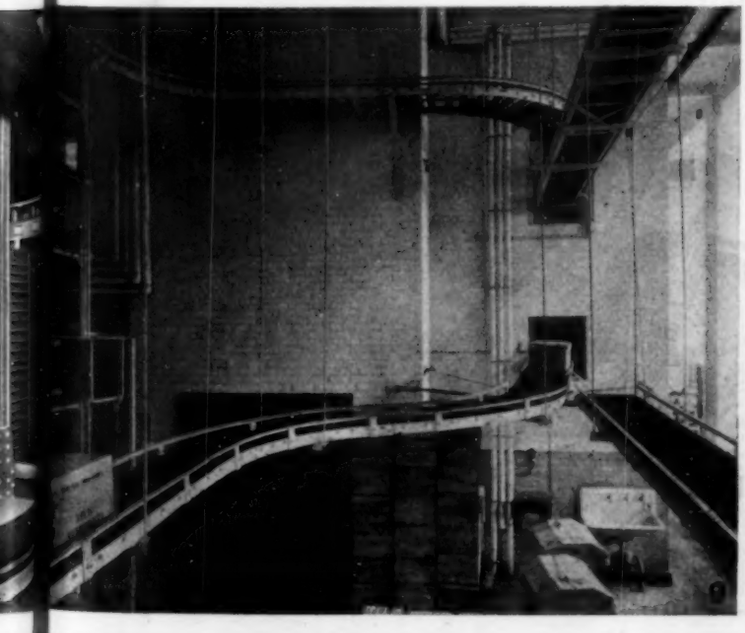
Fig. 8—Details of unloading station

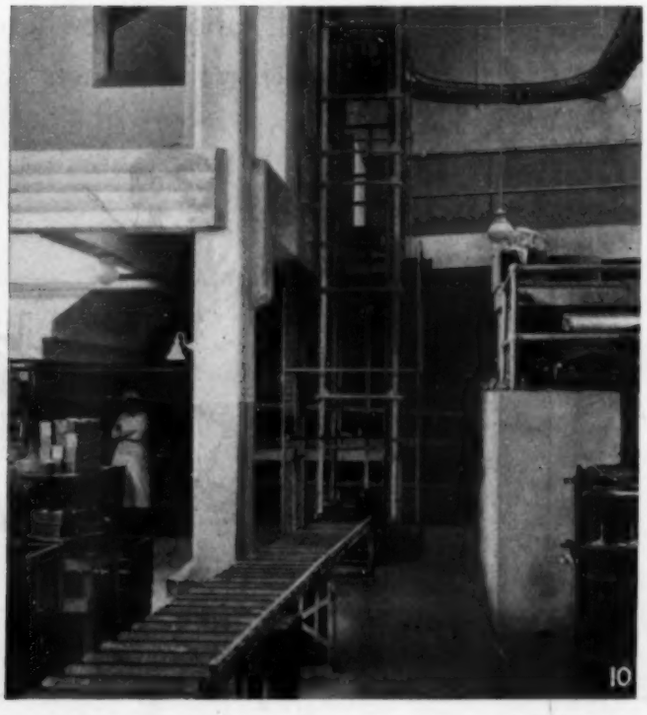
Fig. 9—Gravity conveyor with switch

Fig. 10—Gravity conveyors and automatic elevator

Courtesy of The Lamson Co., Inc., Syracuse, N. Y.



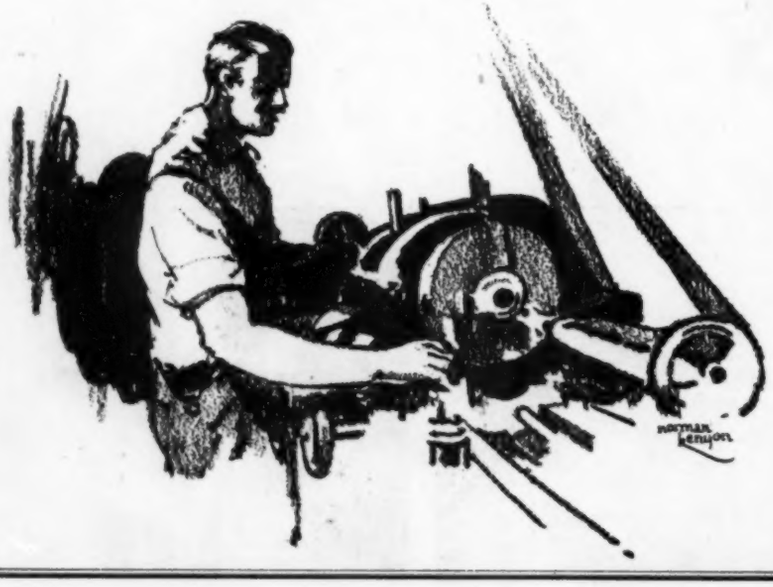




The Mechanic

By Berton Braley

Boss of us all; with grease smudged face
And competent and grimy hands—
He is The Guy who Understands
How to keep all the cogs in place.
The ills of engines he can trace.
He savvies chains, belts, shafts and bands.
In war or peace his skill commands
The labors of the human race.
We are the bondslaves of machines—
He is the Bird Who Makes Them Run,
And knows what every motion means.
And when his earthly job is done
He'll labor somewhere in the skies
Making the planets synchronize.

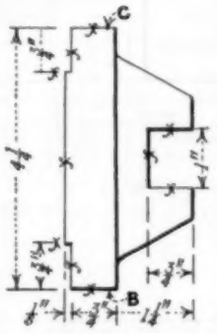


How to Estimate Machine Shop Costs

By Albert A. Dowd

The making of time estimates for shaping operations in production work—Speeds and feeds—Set-ups and procedure for slots and dove-tails

BRIEF mention is sufficient to cover shaper estimating as applied to production work. The shaper is not largely used as a production machine, although for certain kinds of work, such as small slides, dove-tails, tapers of different varieties and for different parts in locomotive work, as well as for certain shapes or contours not easily milled, there are many opportunities for its use in manufacturing. The cutting speed is determined by the number of strokes per minute and the length of the cut, the return stroke being more rapid than the cutting stroke but proportional to it. The number of strokes possible varies on different machines from 6 to 130, or even higher in some cases. Table feeds vary from 0.012 to 0.187 in. per stroke of ram and there are from 6 to 10 changes of speed.



In considering any piece of work which can be manufactured on a shaper we must think of the kind of material and its quality, the method of holding and the stability of the work, the accuracy required and the amount of material to be removed. These factors affect the feeds and speeds which can be used. Methods of holding are similar to those for planing, although the vise is frequently used in shaper work. When the vise is not needed, a table having slots in it can be used for clamping; and for special work, fixtures are often set on the table and clamped in much the same manner as on a milling machine. In the manufacture of tool holders for turret lathes, such as box-tools, slide-tools, dove-tail slides and the like, the shaper is often a productiv machine. It is also employed for taper and straigl gibs, straps, small angular parts, etc.

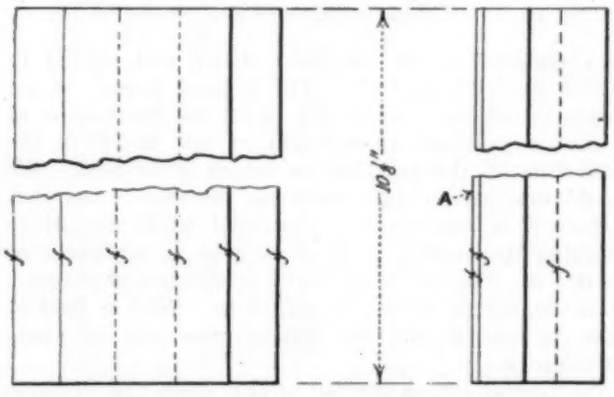


Fig. 45—Cast-iron holder for shaping work estimate

Contrary to the practice in planer work, high speeds and fine feeds will produce better results than slow speeds and heavy cuts. The reason for this is that lighter cutting at higher speeds throws less strain on the working parts and is less likely to cause spring in the work on the machine. The vertical movement of the head is usually controlled by the operator, although an automatic vertical feed can be applied if specially ordered. This, however, is not commonly used and would not be found on the ordinary shaper. The regular shapers range from 15 in. to 28 in. in length of stroke, and the vises for these machines have an opening approximately 9 in. wide for the 14-in. machine, and about 15 in. wide for the 28-in. machine.

In Fig. 45 is shown a cast-iron holder which has a sliding fit on another part not shown. This fit necessiates the scraping of the work after it has been machined, and for this reason too fine a feed should not be used for the finishing cuts.

If we set up the work so that the portion *A* is uppermost and if we clamp it so that surfaces *A*, *B* and *C* can all be cut in the same setting, it will be possible to produce the work with a minimum amount of resetting. As the piece is 10¼ in. long it can be cut at a speed of at least 60 strokes per minute. We can consider feeds of about 0.040 in. per stroke for roughing and 0.020 in. per stroke for finishing. The latter operation can be done at about 90 strokes per minute.

The width of the piece is 4½ in. and an allowance of ¼ in. for finish gives a total cutting width of 4¾ in. The time required for the cut will be the cutting width divided by the product of the feed times the strokes per min. The numerical value of the cutting time is $\frac{4.5}{0.040 \times 60} = 1.875$ min. and to this should be added a trifle for setting the tools up to the work, so that we can allow 2.0 min. in all for this first roughing cut.

For the second cut we can rough down the two ¾-in. shoulders ⅛ in. deep, probably using hand feed but making an allowance for the total cutting width of about 2 in., which should be sufficient to cover the operator's time in feeding the tool to the depth required. The time required will be $\frac{2}{0.040 \times 60} = 0.83$ min.

If a round-nosed tool is used for these roughing cuts, all the roughing operations can be done without changing the tool. The edges of the work can also be roughed by turning the tool holder to suit the conditions. As-

This is the fifteenth article of the series. The fourteenth was concluded on page 697, Vol. 61, No. 18.

sume this to be the case and allow one minute for turning the tool holder around to suit the edges, the cutting width being 1½ in. plus an allowance of ¼ in. Using the same speed and feed, the cutting time for the third and fourth cuts will be 0.73 min. Adding the cutting times for these four cuts gives a total of 4.560 min. for this side of the piece, and the further addition of 1 min. for setting up and removing the work brings the total time for the first setting to 5.560 minutes.

The work must now be turned over and set up for cutting the slot on the other side. For this operation it is necessary to cut down into the metal to a depth of slightly less than ¾ in. for the roughing cut and it would be wise to make two cuts with a narrow tool in order to prevent chatter, finally finishing the slot with a wider tool. Hand feed would be used for cutting the slot and we can consider it to be 0.012 in. per stroke. The distance through which the tool must be fed is 1½ in. for the two cuts and the cutting time, at 60 strokes per min., will be 2.1 minutes.

Since we have previously roughed the other side of the work, we can finish the slot in this same setting, although there would be a possibility of a slight warp in the surface due to the removal of the stresses in the iron. It might be safer to turn the work over again and locate it on blocks in the slot, clamping the piece in such a way that it would not be distorted, and then finishing the side which was first set up. It is hardly likely that this would be necessary, however, so we will assume the present setting all right and proceed to take the finishing cut in the slot.

By using a tool of the square-nosed variety and narrower than the slot, the tool can be fed by hand to depth on one side and then on the other, removing sufficient stock to bring the slot to size. This would be entirely a hand-feed operation and the time allowance could not be easily figured, because it would depend so much upon the ability of the operator. He would need to try a plug in the slot in order to obtain the size and would doubtless require several minutes for the operation, taking not less than three cuts. It would be safe to assume about 3 min. for this operation, giving a total for roughing and finishing the slot of 5.1 minutes.

Finishing Speeds and Feeds

One side of the work has now been completely finished but we have still to finish the edges and complete the finishing of the other side. If we use a finishing speed of 90 strokes per min. with a feed of 0.020 in. per stroke, 1.53 min. will be required to finish across the 2¾-in. surface. The edges should now be trimmed up to size by swinging the tool block to suit and using about the same feed as in the first operation, allowing the tool to drag slightly over the work as this portion does not need to be scraped to a fit. The feeding distance is approximately 1¾ in. and a feed of 0.040 in. per stroke can be assumed. The cutting time will then be 0.486 min., and to this must be added about 1 min. for swinging the tool block, giving a total of 1.486 min. for this operation.

The next operation consists of dressing up the shouldered surfaces and bringing them accurately to size and depth. The operator would be provided with a size block, and a gage for the width of the surfaces. He would use a square-nosed tool to dress up the corners properly and all these operations would be done by hand. The length of time necessary would depend upon the operator and at least two cuts on each surface would be required. An allowance of from 2 to 3 min. would be sufficient and this operation would complete the piece. Summing up the cutting times on the various operations gives 19.176 min. for the total for one piece. If a lot of 50 pieces were to be machined, we would need to allow at least 2 hours for setting up the machine, grinding tools, etc. Therefore, the total time for the lot of 50 pieces will be about 18 hours.

This example gives an idea of the little troubles experienced and the care necessary in shaper work, and the allowances given are such as should be made for the average workman. It may be stated generally that the fewer settings made, the greater the accuracy, other things being equal. Yet, if an extra setting allows work to be done more conveniently and with less chance for error, it might be profitable in some cases. The nature of the work and its accuracy determine these points. Let us now take another example, shown in Fig. 46, and go through this more rapidly, applying the principles already used. This piece is a cast-iron

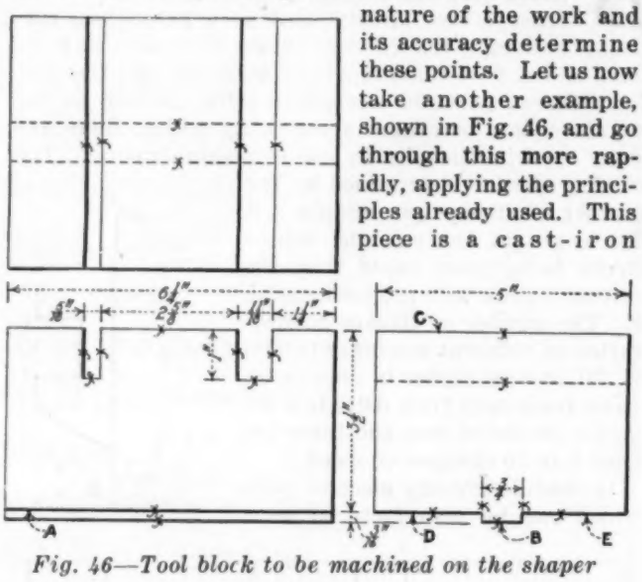


Fig. 46—Tool block to be machined on the shaper

block, finished on the surfaces shown and slotted to receive two cutting tools. The highest degree of accuracy is not required on this work but the tongue at *B* must be accurate as to width, so that it will fit the cross-slide of the machine on which it is used. We should first set up this work on the side *A*, so that surface *C* is uppermost. The total width of cut in roughing the surface *C* is 6¼ in. plus an allowance of about ¼ in. The speed can be 80 or 90 strokes per min. as the length of stroke is only 5 in. With a feed of 0.040 in. per stroke, the cutting time will be about 1.8 minutes.

The second cut on the top of this piece can be made immediately after the first, although the tool would need to be changed and the feed increased, the speed remaining about the same. If we consider the feed to be ⅛ in. per stroke, the cutting time will be about 0.87 min.

Two cuts should be taken in each slot, and a special tool for the ⅛-in. slot would be needed, ground slightly narrower than the slot. The tools would be fed by hand and, if we allow 2 min. for the ¼-in. slot with 3 min. for the ⅛-in. slot, we will have a total of 5 min. for the slotting operation. The setting-up time would not be more than 1 min. and the total time for this side of the piece is found to be 8.67 minutes.

In machining the other side the piece would be turned over and set up on the side just finished, but a rectangular piece of this sort is very easy to set up

and would not require much time. We would first rough the entire surface with a round-nosed tool, first cutting the top of the tongue *B* and then removing the stock from surfaces *D* and *E*. The speed would be the same as in the first setting and the feed would also remain the same. The total width of the work is 5 in. and an allowance of ½ in. gives a cutting width of 5½ in., allowing sufficient time for tool setting for the tongue. The speed is 90 strokes per min. and the feed 0.040 in. per stroke, so the cutting time is about 1.53 minutes.

For the finishing cut on this side any other work on the surface *B* could be neglected, but the edges of the tongue and the surfaces *D* and *E* must be finished carefully. The operator would naturally cut down to obtain the tongue width by hand, after trimming one edge to a finish. It should not take him over 2 min. to size the tongue, a snap gage being provided. The other surfaces *D* and *E* could be finished in about 1 min., making a total for this finishing operation of about 3 minutes.

The setting-up time for this operation should be about 1 min. and the sum of the above times gives a total of 14.20 min. for the piece. For the changing of tools, grinding, and setting of the machine for the work, an allowance of not less than 2 hours should be made.

In the machining of comparatively short dove-tail slides, the shaper is much in demand and the estimator is often called upon to make estimates on this class of work. The piece shown in Fig. 47 is a good example. In considering this work we must remember that if it

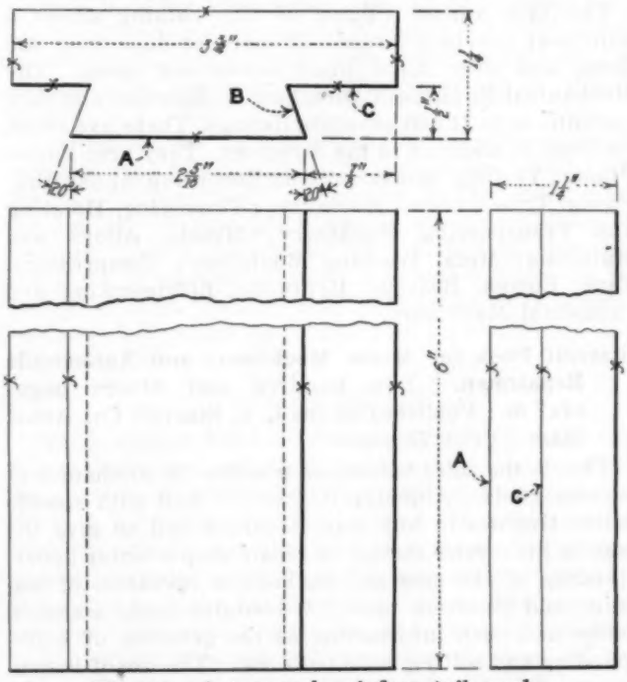


Fig. 47—An example of dove-tail work

were to be done in lots of 25 or 50 pieces, the setting of the head for the angles of the dove-tails would take considerable time. It would therefore be wise to first machine all the angles on one side and then make another setting for the angles on the other side. This method would insure uniformity for all angles on the different pieces and, although the extra setting might cause slight errors now and then, a careful operator would avoid these chances by setting up against the same points each time. Suitable gages should be provided for, if the measurements across the dove-tails were all made by using cylindrical pieces and measuring across them with micrometers, much more time would be needed.

Assuming that we are roughing the dove-tail portion *B* after the skin of the casting has been removed all over, at least three cuts would be required to form the angle properly. The piece would probably be cast straight at this point so that considerable extra stock would need to be removed. If we figure on three roughing cuts and a final finishing cut at comparatively fine feeds, we will have allowed sufficient time. Work of this kind would not be done at a greater speed than 40 strokes per min., as the operator must work carefully to avoid going too deep. With a depth of cut of ½ in. and assuming a hand feed of 0.020 in. per stroke, the time for three roughing cuts will be about 1.88 minutes.

For the finishing cut we should allow for a finer feed at the same speed and the tool would probably be changed. If we use a hand feed of about 0.010 in. per stroke, the time for the finishing cut will be 1.25 min. For incidental time, setting tools, etc., on this operation not less than 3 min. should be allowed and 1½ min. would probably be necessary for setting up and removing the work. Then for the various cuts on this side of the dove-tail, we have a total of about 7.63 min. and the same time will be required on the other side, giving 15.26 min. for the total.

A job of this kind can only be done in the time specified by a good operator, provided with suitable gages and a machine suited to the work. If the man who does the work is not familiar with the cutting of dovetails or angular work, he will spend at least twice this time on the job. It must be assumed, however, that a factory in competition with others on the same kind of work is properly equipped for it, both as to men and machine tools. The other operations on this piece can be estimated by methods previously described. It is important, however, for the estimator to use a sufficient number of settings for the roughing cuts, so that all the internal stresses in the metal will be relieved before any finishing is done.

Standardization a Field for Trade Associations

One of the most striking developments of the standardization movement is the increasingly important role which trade associations are playing in it. According to the Year Book of the A.E.S.C. more than 140 national trade associations are officially participating in standardization projects under the auspices of the American Engineering Standards Committee. That standardization is a legitimate and constructive activity for associations is everywhere recognized, and explicitly so by a recent decree of the U. S. District Court at Columbus, Ohio.

Standardization is essentially a co-operative undertaking and some form of organization is necessary for its study and introduction. To carry out a piece of standardization work throughout an industry, it is practically essential that there be some form of association covering this particular industry. More and more trade associations, no matter for what purpose they may have been organized originally are going into technical work, and will eventually take up standardization.

Book Reviews

A Laboratory Manual of Machine Shop Practice. By John H. Service, B.S. in E.E., and George E. Frease. One hundred and two 5x7½-in. pages. Fully illustrated. Published by D. Van Nostrand Company, 8 Warren St., New York City. Price, $1.25.

This book is intended to assist the practical-mechanic type of teacher in laying out a course of instruction to be followed in school-shop machine work. It is not a text-book of machine shop practice, but tells rather what jobs are to be done, the order of doing them, and how the lessons taught by each job are to be applied. For the actual teaching, it relies upon the practical knowledge and natural ability of the instructor, with frequent references to standard text-books.

It starts with elementary jobs of laying-out, drilling and tapping, chipping and filing, etc., and continues with simple lathe, planer and milling machine work, followed by chapters on the making of reamers, cutters and similar tools, and the calculating and cutting of gears. A final chapter gives working drawings and instructions for making and assembling a small bench drill-press.

Freehand Drafting. By Anthony E. Zipprich, Instructor in Mechanical Drawing, Mechanic's Institute, New York. Clothboard covers, 131 pages, 71 illustrations, 6x9 in. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price, $1.60.

The outcome of a number of years of experience in the teaching and practice of the art of freehand mechanical drawing, this book will be found of real value to many others besides the student and the draftsman. In all lines of industry there are many executives, salesman and others who endeavor at times to elucidate a point or put across an idea by means of sketches. Too many times the point is lost or the idea remains hazy because the sketchmaker has absolutely no proficiency in sketching, and to such persons a perusal of thie little book together with a small amount of practice on the well-arranged exercises, cannot help but be of use.

Sufficient practice along the lines laid down should lead one to be an expert sketcher, but the main feature of the book is the ease with which almost anyone can get a good idea of the principles of freehand drawing. The author has not wasted great numbers of words in telling how it should be done but has explained the essentials of the art by the same means that he teaches —sketches. Proficiency in the making of sketches comes from practice and the exercises given are selected in such a way that they are not only practical but interesting.

About 170 problems and exercises are included and arranged in such a manner that the student can soon become proficient in the art. It is not intended that the book shall make an artist of the reader but that he shall be able to gain in a minimum of time a satisfactory ability in sketching industrial objects.

Starting with a chapter on the fundamentals of mechanical and freehand drawing, the art of lettering is then taken up and followed by practice in drawing lines and curves. Geometrical definitions, principles of projection and sectional views are then considered, each portion of the work being interspersed with practice problems and exercises. The latter part of the book takes up the conventional methods of representation, isometric sketching and shading.

To anyone who wishes to quickly gain some proficiency in the making of freehand sketches, this book can be highly recommended.

Transaction Index. 222 pages, 6x9 in. Published by the American Society of Mechanical Engineers, New York. Price $3.00.

The fifth index which has been issued is really supplementary so far as the earlier volumes are concerned. The references to the first 25 volumes are only sufficient to locate the papers and their authors. For Vols. 26 to 45 inclusive, the references are very complete and an attempt has been made to cover material sometimes hidden in irrelevant discussion. Items have been cross-indexed to a considerable extent.

The present method follows the general style of the Engineering Index, all items being grouped alphabetically under authors names and subjects, excepting memorial notices, which are to be found in the back of the book. The index should greatly increase the value of the *Transactions* by making it easier to locate just the information desired.

A.S.M.E. Condensed Catalogs of Mechanical Equipment 1924-1925. 527 pages, 9x12 in. Published by the American Society of Mechanical Engineers, New York City, N. Y. Price $5.

The 14th annual volume of this catalog shows a gain over previous issues. It includes data from 430 firms and over 2,400 illustrations are used. The Mechanical Equipment Directory is classified and now contains over 31,000 separate listings. There are seven sections in addition to the directory. They are: Power Plants; Testing, Measuring and Recording Apparatus; Power Transmission Machinery; Conveying, Hoisting and Transporting Machinery; Metals, Alloys and Materials; Metal Working Machinery; Compressors, Fans, Pumps, Heating, Hydraulic, Refrigerating and Industrial Machinery.

Starrett Book for Motor Machinists and Automobile Repairmen. Two hundred and fifteen pages 4¾x7 in. Published by the L. S. Starrett Co., Athol, Mass. Price 75 cents.

This is the third volume of a series for mechanics of various kinds. Although it does not deal with specific motor troubles in any way it cannot fail to give the man in the service station or repair shop a better understanding of the uses and methods of operation of machine and precision tools. It contains many standard tables and such information as the grinding of drills, grinding and setting lathe tools, etc. The use of instruments of various kinds receives careful attention.

The British Engineers' Association Directory. Three hundred and eighteen pages, 6½x3½ in. Published by the British Engineers' Association, 32, Victoria St., Westminster, London, S. W. 1.

This is the official directory containing the names, addresses, and nature of business of the members of the British Engineers' Association. It was distributed during the British Empire Exhibition held this summer at Wembley.

Some Fixtures Used in Machining Sewing-Machine Cams

By F. Osgood Hickling
Newark-on Trent, England

The first of two articles—Special care exercised in making the castings—Heavy cuts on small pieces—Accuracy of sizes important—Work must be held firmly without springing

THE needle-bar cam is a component of nearly every type of lock-stitch sewing machine and, though differing somewhat with each type of machine, its functions are practically identical with all. It is the part that causes the up-and-down movement of the needle-bar, and an important feature of its duties is to effect a slight "dwell" of the needle at a certain part of the cycle, the relative time and duration of which dwell has much to do with the action of the machine.

A typical needle-bar cam is shown in Fig. 1. It is primarily a casting of fine-grained gray iron.

The first operation in the shop is the grinding of the face of the casting, for which purpose a disk-grinding machine is employed. The work is held in the hand. Then follows the drilling and reaming of the long hole, ¼ in. in diameter, through the boss and the drilling and tapping of the small hole at right angles thereto for the setscrew, for which purpose the jig shown in Fig. 2 is used.

The jig is built up of machinery steel with all parts casehardened. The work is located in one plane from the surface previously ground and in the other from the side of the long boss, thus insuring parallelism of the hole in both directions. The method of clamping the piece is worthy of study not only because of its security but for the simplicity with which it is effected without obstructing the passage of the work into and out of the jig.

Clamping Details

The L-shaped head of the clamping-bolt *A* is machined upon its projecting shoulder to an angle of 45 deg., which, when the bolt is drawn tight, forces the work to a bearing upon its ground face while at the same time the boss is drawn against the stationary and parallel clamping jaw of the fixture. When the operator turns back the hand-nut *B* to release the piece the bolt itself turns about a quarter of a revolution as soon as the pressure is relieved, swinging the head of the bolt back into the recess provided for it and leaving the passage free for the work to drop out. The first movement of tightening the nut is to swing the bolt-head down until it is stopped by the side of the recess at *C*, when further turning of the hand-nut draws the angular underface against the work. The positions of the drill bushings and the manner of handling the jig are obvious from the drawing.

The next operation is milling the cam-groove, performed on a P. & W. profile cam-milling machine while the piece is held in the fixture shown in Fig. 3. Four of these fixtures are provided and are equidistantly spaced around the faceplate on the work spindle of the machine, being attached thereto by four fillister head screws and two dowels in each fixture. The faceplate revolves continuously and the operator is concerned only in unloading and reloading the fixtures as they pass before him.

Before taking up the fixture in detail we will consider the requirements. First, it is necessary to insure an even thickness of metal at the sides and bottom of the groove, as the necessarily small size of the casting does not allow any latitude in this respect, and to remove too much material in one place would deprive the casting of the requisite strength. Secondly, the groove must be

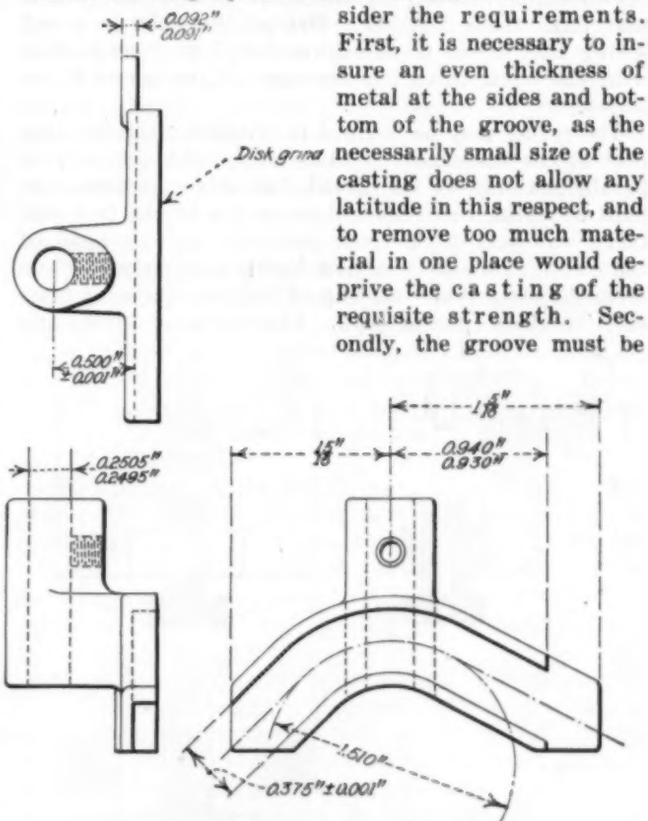


Fig. 1—The cam to be machined

in exact relationship to the hole through the boss, which, of course, determines the position of the cam in the assembly. Finally, the severity of the cut in relation to the small size of the piece demands that the latter be exceptionally well supported, yet in such manner that it will not be sprung either by the clamping features or by the pressure of the cut.

The fixture shown in Fig. 3 is the result of a careful consideration of these details, and it fulfills its purpose in a most satisfactory manner. But one cut is required

to finish the groove, and the limits shown upon the drawing are maintained with the utmost exactness.

The piece is located in the fixture from the ½-in. hole through the boss by means of two plug centers that enter the hole from opposite ends, and the boss is gripped endwise by the pressure of the clamping screw *A* (in the end of which is one of the plug centers) forcing it against the stationary jaw *B*, which contacts

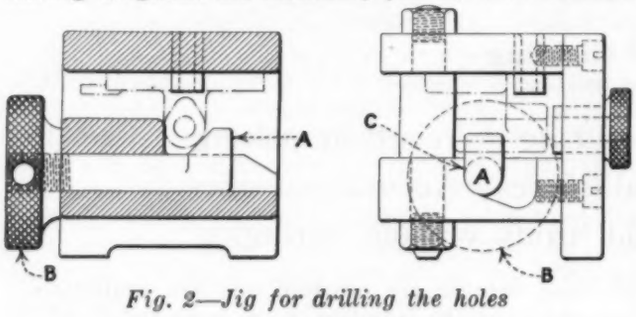


Fig. 2—Jig for drilling the holes

with the contour of the cam at the inside of the curved portion.

The flat, or plate, part of the casting is squared up and supported against the cut from the underside by means of two plugs *CC*, which are advanced and withdrawn simultaneously by the screw *D* and the yoke *E* that links them together. Behind the yoke is a coil spring that serves to withdraw the plugs from contact with the work when the pressure of the screw is released.

The reader may be inclined to criticize a construction that allows the screw *D* to be supported and held in parallelism only by its thread, but this expedient, perhaps doubtful, was rendered necessary by the fact that there was very little room available and the head of the screw, short as it is, now barely clears a projection from the main frame casting of the machine as it travels around its circular path. The screws and the parts

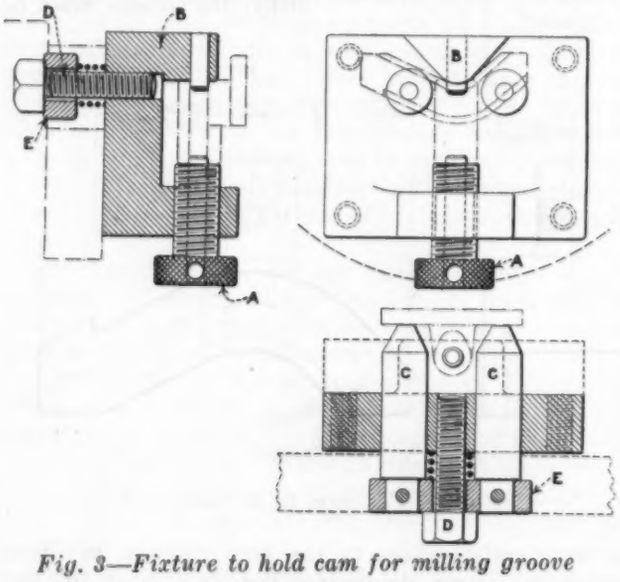


Fig. 3—Fixture to hold cam for milling groove

into which they fit are hardened and the screws are lapped into place. That this method of fitting is justified is proved by the fact that the job has now been in continuous operation for twelve months without serious impairment of the fit.

As is well known, the design of the P. & W. cam-profiling machine makes it quite possible to develop a master-cam from a model piece of work by the simple expedient of transposing the guide roll and cutter, using the latter in the standard head supplied with the machine, and this method was adopted in this case. The four fixtures were located and dowelled to the faceplate with but ordinary means of establishing the location and spacing, the blank for the master-cam put in place, and the model held in one of the fixtures while the corresponding portion of the cam's periphery was developed. The model was then transferred successively to the remaining three fixtures and the process repeated. After the four active lobes of the cam were shaped there remained but to blend them together in a suitable manner.

The fixture shown in Fig. 4 is used to hold the pieces while machining the "foot." As it is essential that one face of this foot be exactly flush with the bottom of the cam-groove, the work is located in the fixture from this point. A formed piece *A* of hardened steel fits the groove tightly and is permanently located upon the body of the fixture. The thickness of the form is slightly in excess of the depth of the groove in the work so that when the latter is clamped upon the form

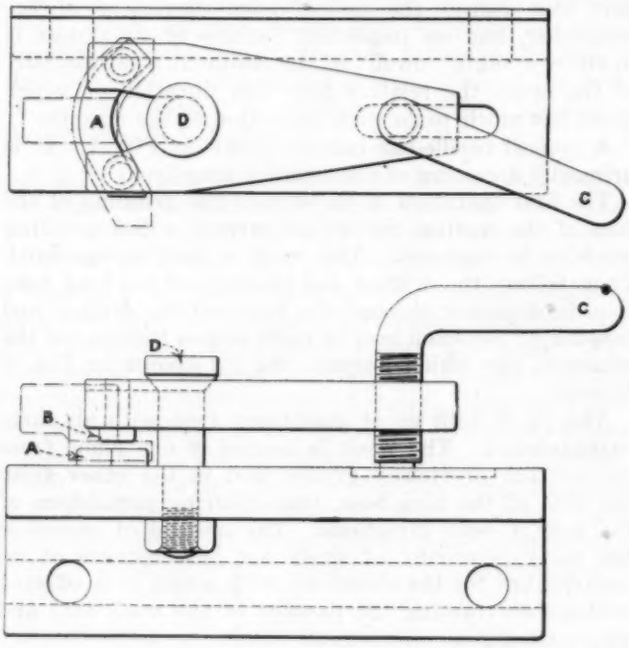


Fig. 4—Fixture for straddle milling foot of cam

the location with respect to the foot to be milled is assured. The work is held by a yoked clamp, or strap, which is provided with hardened steel buttons *B* to bear upon the work.

The clamping screw *C* is bent into a conveniently shaped handle and the threaded end is piloted to register in a groove milled in the body of the fixture. The shoulder of the fulcrum screw *D* is spherical in shape and the sides of the open slot in the yoke-strap conform to it so that the slight tilting caused by tightening the screw does not affect the bearing at this point.

The object of the piloted end of the clamping screw and the groove in which it slides, and also of the open slot at the yoke end of the strap, is to allow the strap to be drawn back quickly for the purpose of changing the work and brushing out the chips, yet to prevent it from becoming disengaged altogether and thus causing delay in operation. The fixture is used in a hand milling machine and the cut is taken with straddle mills. A tolerance of minus 0.001 in. only is allowed.

Ideas from Practical Men

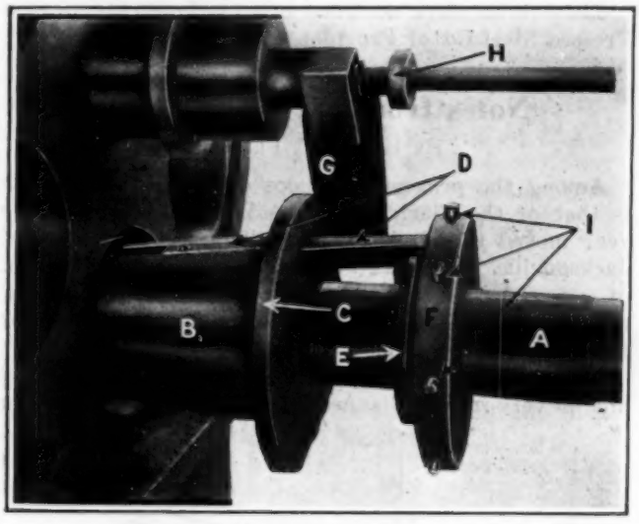
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Boring Bar for Tapered Holes

BY HENRY DENSMORE

The illustration shows a bar and head for boring tapered holes, suitable for use in a lathe or horizontal boring mill. It is simple in construction as well as efficient in action, and possesses the advantage of having no complicated parts to get out of adjustment. The bar *A* is mounted on the centers of the lathe or mill and is driven by a dog, the tail of which engages the slot in the regular driving plate.

Since the work is mounted on the carriage, to bore a hole larger or smaller, the carriage has only to be moved to the right or left, respectively, and no radial adjustment of the cutting tool is required.



A simple and effective taper-boring rig

The head *B* is keyed and setscrewed to the bar, having no movement relative to the latter. It is machined all over, being turned to the same taper as that of the hole to be bored; though if there is plenty of clearance between it and the hole, the turning is not essential. It has a narrow flange, C, the periphery of which is concentric with the body except that it is cut away for a short distance in one place to allow it to act as a cam.

A dovetailed slot is planed lengthwise of the head to receive the slide *D*, which is the tool-carrier. The angle formed by the extended intersection of this slot with the centerline of the bar is an important point, as upon it depends the angle, or taper, of the hole the tool will bore. The tool-slide *D* passes through a clearance hole in the flange and the collar *E* is loosely attached to its outer end.

Nut *F* is threaded to the bar and advances or recedes along the threads as it is rotated upon the bar. The collar *E* is so coupled to the nut that it must advance or recede with it, but is free to rotate with reference to it. Thus, if the bar is in rotation and the nut is held stationary—by hand or otherwise—both the head *B* and the collar *E* will continue to rotate with the bar, while the tool-slide *D*, collar *E* and nut *F* will move endwise with relation to the head at a rate dependent upon the lead of the thread on the bar. The cutting tool is a high-speed toolbit fastened by a wedge in a hole near the end of the tool-slide and projecting radially from it.

All the movements necessary for taper boring are thus provided; but if the nut *F* were to be held stationary all the time, either the thread on the bar would have to be of very fine pitch or the feed would be altogether too coarse. Therefore means are provided for retarding—or rather intermittently stopping—the rotation of the nut.

The part *G* is a piece of heavy sheet steel, bent at the lower end to form an L-shaped hook, the bent end of which projects inwardly toward the axis of the bar. Its width (considered lengthwise of the bar) is sufficient so that while one end of the hook rests upon the smooth flange of the head *B*, the other end projects beyond the extreme outward position of the nut. The upper end of part *G* swings loosely upon the stud *H*, which is attached to the piece of work being bored. It is so attached in this case because it is convenient to do so; it could as well be attached to any stationary part of the machine.

The diameter of the nut *F*, measured over the radial pins *I*, is the same as that of the smooth flange on the boring head. It follows, therefore, that as the bar revolves, the hooked end of part *G* will ride on the flange and will not interfere with the nut; which continues to revolve with the bar merely because there is nothing to prevent it from doing so.

But a portion of the flange equal to a little more than the circumferential distance between two of the radial pins in the nut has been cut away. When this cut-away portion reaches the hook, the latter falls by gravity (or a spring if necessary) until the opposite end rests upon the smooth periphery of the nut. As the parts continue to revolve, one of the pins engages the hook and the nut is held stationary until the advancing rise of the cam again disengages it. The tool is therefore fed forward by a distance equal to one-eighth of the lead of the thread—there being eight pins in the nut—at each revolution of the bar.

This device is regularly employed on production work, and the relative factors have been calculated to give the maximum feed permissible on that work. The factors are: the lead of the screw, and the number of radial pins in the nut. The cut-out portion of the flange must be greater than the space between two of

the pins, but must not equal two spaces; else the feed will be doubled.

By making the flange in two parts, rotatable with reference to each other, the length of the gap could be increased or diminished at will. Then if there were a large number of radial pins in the nut, any amount of feed within a reasonable range could be secured.

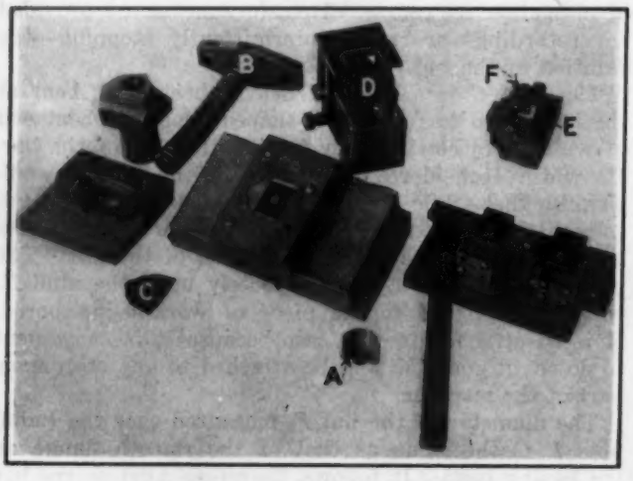
This device was designed and is in service in the shops of the New Britain Machine Co., where it is regularly employed in boring the tapered holes for the adjustable spindle-bearings in the carriers of the New Britain automatics.

How Would You Make this Shell?

BY WILLIAM DENTON

Nearly every tool designer who has been asked how the shell shown at *A* in the accompanying illustration was made, has said "Why! you just drew up a complete shell and then cut it in two."

Such a method, while offering an apparently simple solution, has two objectionable features, one of which is sufficient to put it beyond consideration. It is necessary that the straight sides of the finished piece shall remain parallel with each other, and that the distance between them—the diameter of the semi-circular shell—be within a tolerance of 0.002 in.; easy enough to attain



Tools for producing the shell

in the complete shell but impossible to retain when the strains of drawing are released by cutting the shell apart. The other objection is a practically 50 per cent waste of material.

The piece was made from 0.035-in. flat brass in three operations, with no waste except in the blanking. The tools here shown are, from left to right, blanking, forming and shaving. The latter operation removes but a very thin shaving of metal from the contour of the bottom of the shell, and only a close inspection with the contour gage will reveal a difference between the products of the second and third operations.

The job is really a very simple one and the tools are easy to make—after you have discovered what shape to make them. The forming tool is made first and experimental blanks are cut out by hand until exactly the right shape and size has been found that will draw up into the finished part without wrinkling or leaving excess metal. Two blanks must be made at each trial and one of them preserved as the point of departure from which to make the next one.

Little, if any, description is needed to cover the tools. The recess of the forming die is made to fit a hand-formed shell and the punch is fitted to the die with the proper allowance for the thickness of metal. It is of no use to make a permanent "set-edge" until you know what the shape of the blank is to be. The round pin to be seen in the center of the forming die is a knock-out, and has a large, round head below the die to rest upon the spring *B*, which is attached below the press bed. The pin also serves in a measure to prevent shifting of the blank after the draw has begun. Once the shape of the blank *C*, has been found, a simple punch and die can be made to reproduce it indefinitely.

The reason for the extra hole in the pad of the punch holder is because the spring blank-holder, *D*, was originally made to cover the entire blank, but this was found to be a mistake and it was sawed in two in the middle, leaving but one spring plunger necessary to support it.

The operation of the shaving tool is obvious. The hand lever brings in two sliding plungers, one from each side, to hold the formed shell in the die. Part *E* is the actual shaving punch, while part *F* is set upon a spring and after coming in contact with the bottom of the shell it recedes into the holder as the punch continues to descend.

These tools were designed and made by the Beacon Pressed Steel Co. of Providence.

Notes from a Florida Plant

BY HENRY C. FRANCIS

Among the progressive shops of the extreme south is that of the Florida Machine Works which has this year moved into its new plant in a newer section of Jacksonville. One of the innovations is the building of a good locker room which provides locker space for every employee as well as modern shower baths for both white and colored workers.

There is also an electric furnace for melting steel and a very modern annealing oven, the latter being

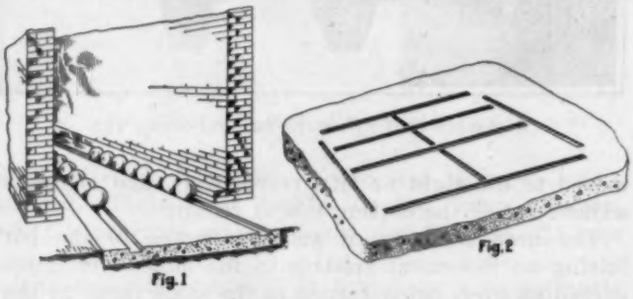


Fig. 1—Ball carriers in furnace. Fig. 2—T-slots in erecting floor

shown in Fig. 1. The oven is of firebrick and is provided with two grooved runways which carry large iron balls used in handling the material, either in large steel boxes or anything that will roll on the balls. The balls have been found more satisfactory than cars with wheels and axles and their attendant troubles in a heated furnace.

Another innovation is the construction of the erecting floor which is shown in Fig. 2. The T-slots in the floor afford an opportunity to bolt machinery down in almost any position, either for erection or testing and are formed by rolled-steel sections set into the concrete at right angles and flush with the floor.

Grinding Paper-Cutter Knives on a Planer

By Henry C. Francis

Regular knife-grinding machines cost money and are hardly warranted when only an occasional knife is to be ground. So the foreman of the Jacksonville Engineering & Machine Works, Jacksonville, Fla., rigged up an old planer for this work.

The knife to be ground is held on the upper side of the plate *A* in the fixture shown. The plate can be

Grinding knives on the planer

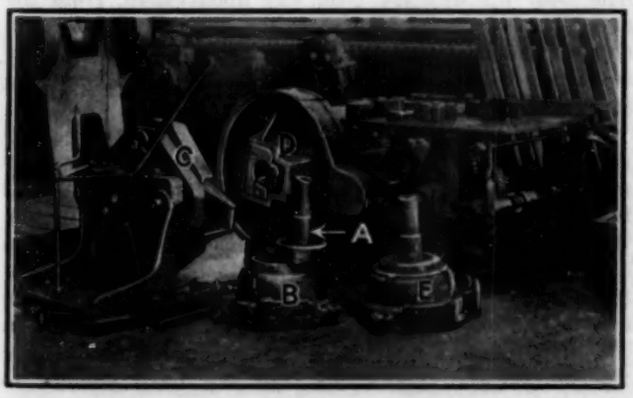
swung to any angle to get the proper bevel on the cutting edge. The grinding is done by the portable electric grinder fastened to the tool head of the planer. By swiveling the grinding attachment, almost any concave can be secured on the bevel, varying from the curvature of the wheel to flat, if the wheel is turned in line with the travel.

Machine for Screwing Parts Together

By Francis C. Henry

One of the driving cases that form part of the electric truck built by the Commercial Truck Co., Philadelphia, consists of two parts screwed together so as to form what is practically an integral unit. These parts are shown at *A* and *B* in the accompanying illustration and, as will be noted, the threaded portions are of a fairly large diameter. The mating threads are made a very sung fit and require considerable power to screw them together for the entire length of the thread on the piece shown at *A*.

This operation was formerly done by hand and required the expenditure of much physical labor. Besides, the results were not always entirely satisfactory. In order to secure uniformity, the machine shown was designed to screw these parts together by power.



Machine for screwing parts together

The case is mounted on the fixture *C* which holds it firmly and in line with the power head *D*, this head having jaws which grip the part *A* and screw it into the case by means of the gearing shown. The frame *C* advances along its track as the two parts are screwed together. They become practically one piece as shown at *E*.

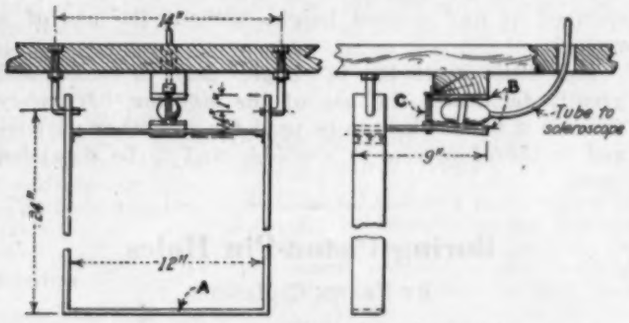
By providing jaws of various sizes, and suitable fixtures for holding the case, the same machine can be used on a variety of sizes.

Increasing the Speed of the Scleroscope

By Ronald L. Jones

Anyone who has operated a scleroscope continuously, will realize the value of a device that will eliminate the necessity of squeezing the bulb by hand.

The device illustrated is operated by the foot at *A*. By a three-inch movement of the foot, the bulb can



Device for speeding the scleroscope

either be compressed or released, giving the same action to the instrument as when operated by hand.

The bulb is attached to two pieces of felt, as at *B*, by a little glue or rubber cement. The adjustable stop *C* prevents the bulb from being pinched.

Reversible-Head Plug Gage

By H. S. Pierce

The sketch herewith shows the details of a reversible-head plug gage that has been developed for use in the plants of the Studebaker Corporation, Detroit, Mich. The parts consist of the handle *A*, the heads *B*, the cylindrical bushings *C*, the screws *D* and the washers *E*.

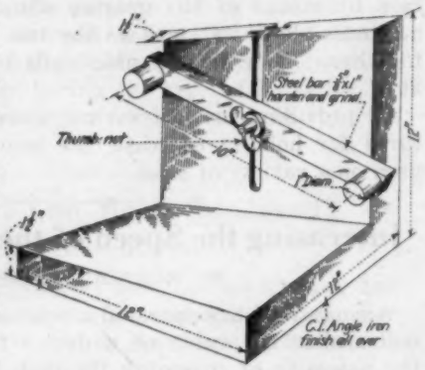
Reversible-head plug gage

The ends of the handle are conical and are tapped for the screws. The bushings *C* are tapered inside to fit the ends of the handle and are split so that when the screws are tightened against the washers, the bushings will expand and thus form a snug fit. This device makes it possible to reverse the heads, either to double the life of the gage or so that different dimensions can be gaged with the opposite ends of the heads.

An Angle Plate for a Sine-Bar

BY H. L. WHEELER

The illustration shows an angle plate designed for use in connection with a sine-bar, rendering the use and application of the latter very convenient. Dimensions are attached to the sketch for the convenience of any reader that may desire to make one for himself.



An angle plate for a sine-bar

The casting should be machined all over, taking especial care to make the angles exactly 90 degrees. A T-head bolt passes through the bar at the center and is fitted with a thumb nut so that the bar may readily be clamped at any desired height without the use of a wrench.

This little accessory is simple, easy to make, and greatly facilitates the use of the sine-bar. If nicely finished it is not likely to be used for any other purpose and is therefore always available and to be depended upon.

Boring Piston-Pin Holes

BY FRANK C. HUDSON

One of the problems in automotive-motor manufacture is the cross boring of piston-pin holes at right angles to the piston itself. The method shown in Fig. 1, utilizes a fixture designed by The Warner & Swasey Co. for use in connection with its hand turret lathe for handling aluminum pistons. Details of the piston are given in Fig. 2. The inside of the skirt is bored to fit over the pilot *A*, Fig. 1, and the projection *A*, Fig. 2, used as a center in turning the piston, also affords a locating point by which the plunger *B*, Fig. 1, holds the piston in the proper location for the cross-boring operation.

In operation the fixture is loaded so that the piston holes line up with the lathe spindle, using the pilot or centering bar shown in position. The holes are drilled, using the floating bushing shown, then bored with a bar having a pilot which reaches into the bushing in the lathe spindle. The holes are next recessed, as in Fig. 2, by the tool shown at *C*, Fig. 1, to hold retaining springs at each end of the piston pin. A final reaming

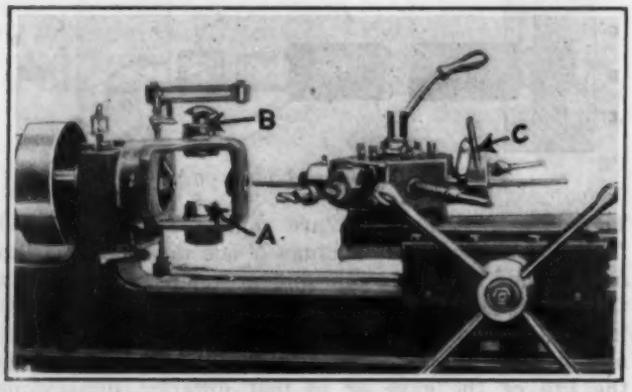


Fig. 1—Fixture and tools for boring piston-pin holes

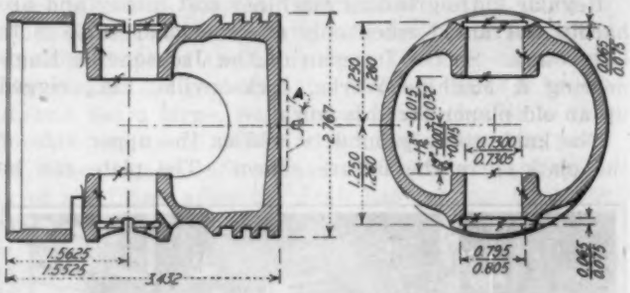


Fig. 2—Details of an aluminum piston

completes the operation. The convenience of this fixture and the rapidity with which the work is done can be judged from the fact that the total time for an aluminum piston is 54 sec. each.

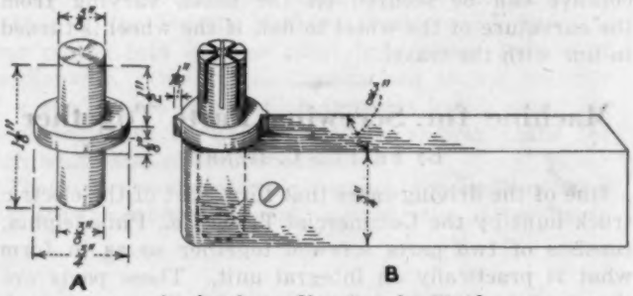
A Simple Radius-Turning Tool

BY A. W. SWAIN

The accompanying sketch shows a simple radius-turning tool that was devised by one of my men for doing some special work requiring an accurate radius.

He took a short bar of tool steel of suitable size and, gripping it in a lathe chuck, turned it as shown at *A* in the sketch.

After cutting it off he sawed a couple of slots in one end as may be seen at *B*, and milled away most



A simple radius-turning tool

of the periphery of the larger diameter, leaving two cutting points as the sketch shows. When these were properly filed for clearance the tool was ready to harden.

For a tool-holder he took a rectangular bar of cold-rolled stock ⅝x¾ in. of suitable length, drilled a ⅜-in. hole clear through the ¾-in. way about ⅞-in. from the end, rounded the end to a radius somewhat less than that of the tool, sawed a slot into the end of the bar for some distance past the hole and put in a clamping screw.

To turn a radius with the tool an ordinary round-nose tool is first used to dig out the stock approximately to size, leaving a little for finish. The improvised holder is then set into the toolpost with the cutting edge of the tool about level with the centers of the lathe, the tool brought up to the work and fed to the cut by turning it around with a screwdriver in one or the other of the slots. The clamping screw in the holder is set up just tightly enough to put some friction on the tool shank, but not hard enough to bind it.

Technical Abstracts

The Plant Restaurant

Sanford DeHart, director of the employment department of the R. K. Le Blond Machine Tool Co., Cincinnati, points to the increase in the number of industrial restaurants in operation, there being today more than 5,000. New methods of bookkeeping, modern equipment and changes in dining room personnel have transformed the plant restaurant into a department that has as good standing as any other in the plant.

Analysis of what employees want indicates that the first thing is quick service—this is not always possible with a waiter service and hence the men prefer the cafeteria or self-service type. One plant changing its restaurant over from waiter service to cafeteria service saved $6,000 in wages and actually reduced the breaking of china some 50 per cent. There was also a great saving in food wastage. Another concern installed a conveyor system in the dining room, belts being placed along the side of the counters. Each belt is stretched from one end of the counter to the other. While lunch is being served the belts are put into motion by small electric motors and kept moving at the speed one would ordinarily walk. The diner places his tray on the belt as he enters. He then fills it with the various dishes as he goes along. Belt conveyors running along the outside rear walls of the dining room facilitate the work of getting soiled dishes back to the dish-washing room, doing away with the noise that one usually associates with cafeterias. —*Industry Illustrated*, October, p. 36.

Studebaker Gray Iron Foundry

The largest unit foundry in the country has just been completed by the Studebaker Corp., South Bend, Ind. It measures 683x722 ft., and covers 11 acres of ground space, having over 13 acres of floor space. This plant is noted for its layout; its labor-saving equipment; its unusual illumination and its ventilating and heating facilities. One outstanding feature is the raw material storage bay, an entirely enclosed structure where metal, fuel and sand are protected from the elements. A plan of the layout is given and several photographs of the different parts of the floor.

The foundry is designed to produce 500 tons of finished gray iron castings daily or the entire requirements of the South Bend and Detroit plants. Some 900 people will be employed.

One of the most impressive features is the sand storage department that has eight concrete sand storage bins, two of them, 40x40x37 ft., the remaining six 20x40x37 ft., having a combined capacity of 450 cars of sand, amply large enough to carry the foundry through the winter.

Atmospheric circulation is created by a heating system and is promoted by continuous sash in the monitors and side walls. All of the sash is electrically operated. The heat is carried out by air being drawn through hot water coils and discharged through the columns into the foundry above. Hot water is supplied through the company's power plant.

The floor in the molding room is of brick containing a special composition of fire clay to prevent burning by the molten metal. A laboratory is incorporated in the building. With this article should also be read the one on page 843 on Conveyor System in the Wilson Foundry & Machine Co., Pontiac, Mich. This system was laid out by John T. Stoney of the Stoney Foundry Engineering Equipment Co., and built by the Chisholm-Moore Manufacturing Co., both of Cleveland.—*The Iron Age*, Oct. 2, p. 835.

Piston Ring Production

It is of great importance that the casting from which rings are machined be of uniform quality. Hard spots in the material will cause poor rings. There are no castings that should be given more careful attention than those from which piston rings are made. Two methods of producing piston rings are employed, in one the rings are produced from individual casting, while in the other they are machined from a cylindrical casting. Rings made from individual castings are generally stronger as the dense grain of the metal found close to the outside skin of the casting is incorporated in the ring. Unfortunately they are more difficult to produce and more liable to be a poor fit than the others.

The first operation on the cylindrical or pot casting is generally that of turning the outside diameter eccentric with the inside, usually done with a cylinder boring head adjusted to cut about ¼ in. ahead of the tool which turns the outer surface. This method tends to produce more accurate rings as the rigid internal cutter serves to reduce vibration and distortion. The parting tools are located so that each one has a slight lead over the preceding one and the rear edge of each tool also has a lead over the other edge so that the rings will cut off cleaner. They may be subjected to a simple test after the first operation. This consists of cutting through one side of the ring with a hacksaw, measuring the opening or slot slipping the ring over a slightly tapered mandrel to a step having a diameter equal to the outside diameter of the piston plus $\frac{1}{16}$ in. If there is any appreciable increase in the slot after this operation it indicates that a permanent slot has developed and the ring is too soft.

The second operation is that of grinding the sides. The smoothest face of the ring should be placed in contact with the magnetic chuck when grinding the first side. It is the usual practice to mount a number of rings on an arbor when grinding them to fit the cylinder bore. It is poor practice to grind them with a closed slot, but it is possible to produce a ring that has a closed slot when finished. This is done by grinding the ring with an open slot and regulating the diameter to which it is machined so that its circumference after being slotted and ground is exactly the same as that of the bore it is to fit.—*Machinery*, October, p. 93.

Design of Walls for Japanning Ovens

In Gordon Lefebvre's paper before the S. A. E., he brought up the question of wall construction and mentions the most recent practice of the Chevrolet Motor Car Co. as being the most practical.

The inner shell is formed of No. 22 gage standard width sheets. The edges of the sheets are broken to form 2-in. double lap joints with the adjacent sheets. The sheets are joined, riveted through the laps and erected in a vertical position with respect to the joints to give structural strength. The inner shell of the floor and the roof is formed in the same manner, except that in the case of wide ovens it is necessary to add stiffening strips at each lap joint to carry the weight. Two-inch block magnesia is laid against the outside of the sheets and fitted tightly between the outstanding 2-in. joints. Small holes are punched every 12 in. in all joint edges and short lengths of No. 16 gage annealed wire inserted. The wires are twisted once and the two ends left free. Expanded metal lath is laid against the magnesia block, with the ribs horizontal to prevent excessive convection currents. Annealed wire is used to fasten the lath, a short length of this wire being exposed beyond the lath. Against the lath is laid another layer of magnesia block. In the case of body ovens, section No. 1, these blocks are 1 in. thick; on the fender ovens, section No. 4, they are 3 in. thick. Over this last layer of magnesia 2-in. mesh poultry netting is tightly drawn and secured with the protruding ends of the annealed wire. A ½-in. coat of asbestos plaster is applied over the netting, and then a finishing coat of half and half asbestos and cement plaster, which completes the oven wall.

Illustrations are given of exactly how this work is carried out.—*Fuels and Furnaces*, October, p. 1074.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

A Conservative Triumph

THE result of the national election is most satisfactory to those connected with American industry. The verdict of the people on the proposal to experiment with government ownership of utilities leaves not the slightest doubt of the lack of faith in such measures.

It seems clear at this writing that President Coolidge has not only won a convincing popular triumph but the more practical support of a real working majority in both houses of Congress as well. Such being the case there is no reason why the sane and desirable legislation lost in the last Congress should not be reintroduced and passed. The outstanding example is, of course, the Mellon plan of tax reduction. At the same time the fear of such radical measures as the Howell-Barkley railroad labor bill is largely removed.

The hesitating revival of business that awaited the result of the election will now go forward with assurance. We look for immediate improvement in the branches of the metal industry that produce for the consumer market and a somewhat slower, although equally sure, revival of the market for production equipment.

What Ails Aviation in America?

WE POINT with justifiable pride to the invention of the practical heavier than air machine for which credit must be given to Langley, Wright, Curtiss and others. We have likewise built planes with which wonderful records have been made, both as to speed, load and duration of flight. The building of the Douglas world cruisers is of itself a noteworthy achievement. Noting all these things one might seem justified in asking if anything ails aviation in America.

The recent races at Dayton, however, as well as numerous other things, indicate that there is decidedly something the matter. For in spite of the millions spent at McCook Field and elsewhere the army did not have a single new plane in the air at this meet. Instead it flew Curtiss ships two years old, which had been stressed to such an extent that two of them went to pieces, carrying two of the best army pilots to untimely deaths.

The trouble with American aviation is that we have no kind of a policy, continuous, intermittent or any other kind. We are, according to a keen British observer, in exactly the same position as Great Britain was before the advent of their present Air Minister. It is the Air Minister's job to see that the British aircraft industry is preserved for future usefulness by keeping it reasonably busy and giving it a square deal. In contrast with this we find our own aircraft industries struggling along or closing their doors and allowing their trained personnel to scatter to other fields.

The British Air Ministry has decided that some twenty firms have proved themselves worthy to be kept alive for the benefit of the country itself. When one of these firms produces a plane that is worth putting into production, a price is agreed upon for a definite number. In order to keep the other firms alive they receive sub-contracts from the same order, unless designs of their own are considered good enough to build in quantity.

The plan works well and all of the twenty firms are kept reasonably busy. They know that when they bring out a sufficiently advanced design, their firm will get the next big order, and their competitors will have the sub-contracts. The firm getting the order is responsible for its sub-contracts, leaving the fate of the industry in its own hands. The Air Ministry takes pains to keep on placing orders as regularly as possible so as to keep the industry working and avoid the expense of shut downs.

Such a policy would do much for the aircraft industry in this country. As it is the millions are, for the most part, spent at McCook Field and the Naval Aircraft Factory while the builders who have developed the only ships both army and navy are using, are compelled to close their doors or run with a skeleton force.

Both McCook Field and the Naval Aircraft Factory have their place. But without a responsible and progressive air ministry, under whatever name, they are costing millions which should be spent in securing increasingly better planes and equipment from our most progressive builders.

We are spending about $400,000,000 for aviation, of which the Post Office gets but 2 per cent. Yet we have comparatively few planes and not a single new ship to fly in the races at Dayton.

A capable Air Secretary would go far toward removing the ills of American Aviation!

The Compromise Design

THE stern spirit of "No Compromise," as voiced by the oratorical friend of the people, has long since passed from the machinery industry. All three parties to the final result, the engineering department, the sales department and the shop, know full well that anyone who professes such principles is as little worthy of credence as the political demagogue.

Speaking at the Production Dinner of the Society of Automotive Engineers, President Crane expressed the situation succinctly. In the automobile business, as he put it, there are three designs a year: the one demanded by the sales department, the one laid out by the engineering department and the one finally built by the production department.

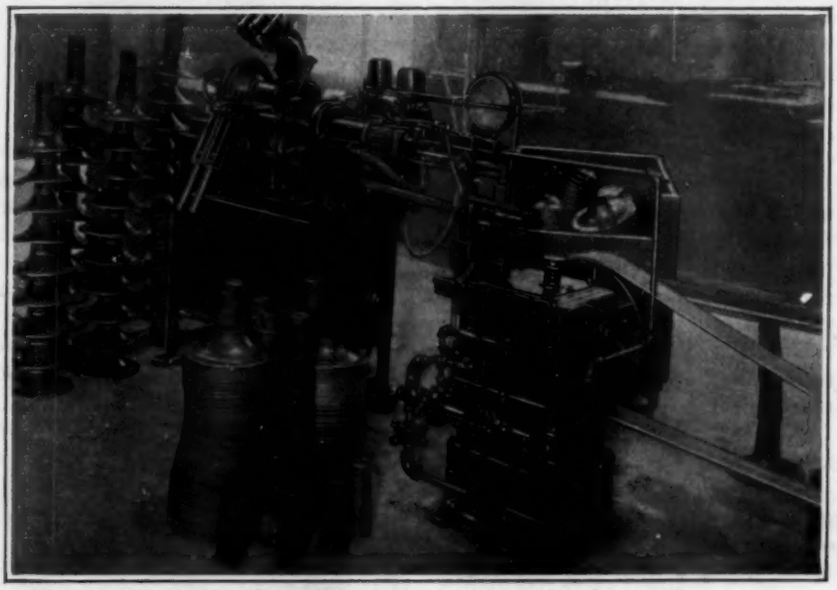
There is a chance, of course, that the compromise design offered to the public will be decidedly below the standards set by each of the departments interested. On the other hand, if the compromise is effected by a wise general manager it may include the best thoughts offered by each of the three branches of manufacturing activity, and be far better than it would have been had it expressed the ideas of only one.

Machine tool builders should be the first to scrap obsolete tools.

Shop Equipment News

Thomson Model 15 Automatic Butt Welder

A recent addition to the line of automatic electric welding machines manufactured by the Thomson Electric Welding Co., Lynn, Mass., is its Model 15 automatic butt welder. This machine is shown in the accompanying illustration as arranged for welding pressed-steel pedestals, a quantity of the work being shown around the machine.



Thomson Model 15 Automatic Butt Welder

The machine is equipped with a transformer having a capacity of 62 kva. and can be operated on the usual commercial a.c. lines. The clamp on this particular machine is specially designed for the pedestals which, at the point of weld, are about 2½ in. in diameter and 0.075 in. thick. The machine can be readily equipped to handle stock with a cross-section of any ordinary shape, the sectional area varying from 0.1 to a maximum of 0.5 square inch.

The parts are inserted in the welder and clamped by hand and the operator then trips a short hand lever located on top of the machine. The movement of this lever automatically turns on the current and starts the movement of the platen, the work being "flashed" until the required heat is obtained. A final welding pressure is then automatically delivered and the current is cut off.

The pressure is generated through an Oilgear pump driven either from a lineshaft or a motor, as desired. As soon as the clamps are open the platen travels back to its starting position and is ready for the next welding cycle. The speed of the machine is limited only by the rapidity with which the operator inserts and removes the parts.

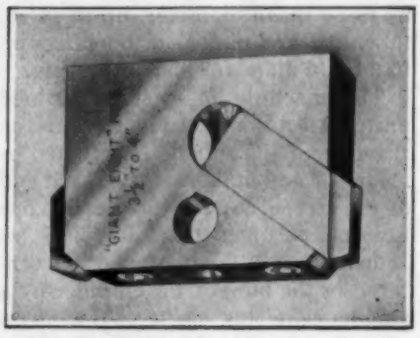
The actual time of the current flow on the job illustrated is approximately two seconds. In the design of the mechanism care has been taken to make it flashproof and capable of continuous operation.

Davis Expanding Blocks

The Davis Boring Tool Co., 3730 Forest Park Blvd., St. Louis, Mo., is now marketing an expanding block-type boring tool. The device is a self-contained unit, consisting of a steel block carrying two cutters that are locked in position by means of adjusting and locking screws. The screws are of hardened steel and are tapered on the ends to correspond with the angles of the cutters, so that a good bearing is obtained at the point of contact.

The adjusting screws are manipulated by means of a wrench that carries a dial graduated in thousandths of an inch. When set, the tools are locked in position by set screws, so placed that they will force the cutters back against the expanding screws and against the sides of the blade-slots, thus forming a rigid tool.

Center-holes are provided in both ends of the block so that the cutters can be ground between centers, if desired. The block is locked into the bar in which it is used by means of a taper pin, for which purpose a taper hole is provided in the block. A groove in one side of the hole insures accurate setting of the block, making it possible to remove and replace the block without variation in the setting. The blocks and tools can be used in sets for rough boring, semi-finish boring and finish boring.



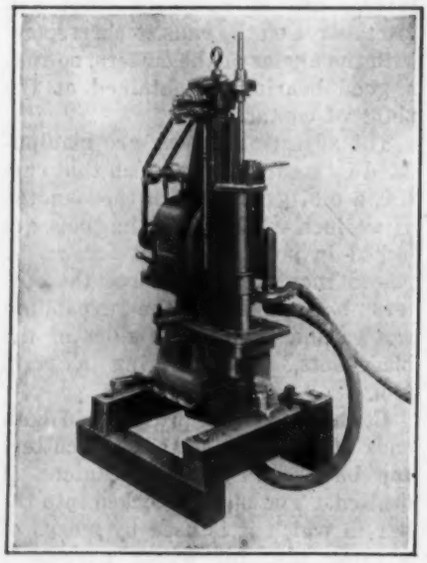
Davis Expanding Boring Block

The same type of block can be furnished with cutters for boring into and squaring the bottom of a hole, or for boring in advance of the body of the tool. The block can also be used as a floating tool in a hole that has been previously bored to within 0.006 or 0.008 in. of the finish size.

A set of eight blocks covers a range of from ¾ inch to 18 inches, inclusive, and multiple block cutters can be supplied to bore, face or counterbore two, three or more sizes simultaneously.

Gisholt "Du-All" Cylinder and Piston Grinder

A portable cylinder grinder and piston-fitting machine is now being marketed by the Gisholt Machine Co., Madison, Wis., and is designated "Du-All." It is especially adapted for use in service stations, since it is a compact, rigidly-built machine and



Gisholt "Du-All" Cylinder and Piston Grinder

is comparatively simple to operate. The machine will grind holes from 2½ to 5¼ in. in diameter, up to 14 in. in length, and pistons or bushings up to 6 in. in diameter and 10 in. long.

The machine is a self-contained unit. An automatic reverse for the traverse of the spindle is actuated by means of adjustable trips at each end of the stroke. After the grinder has been placed upon the motor block, as shown in the illustration, it is centered in the bore of the cylinder by a simple centering device. The base of the machine is then clamped to the block. The depth of cut is shown by dials on the feeding mechanism, both power and hand feeds being provided. The grinder head gives two speeds for the wheel.

The upper part of the machine is mounted upon a swivel base so that it can be swung to one side for measuring the hole. The saddle containing the gear box and driving mechanism is completely inclosed.

A ¾-hp. motor for either 110 or 220 volts is mounted on the column of the machine and can be connected to any convenient lighting circuit. A suction fan and hose attachment is provided to carry away the dust from grinding. A diamond for truing the grinding wheel is furnished with each machine, and can be conveniently located on the base.

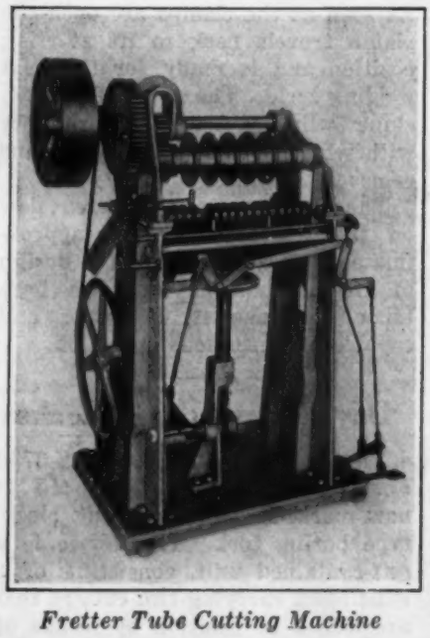
The external grinding attachment for pistons and bushings consists of a crosshead pin that keeps the piece in place on the stepped faceplate, and an external grinding wheel with the necessary drive and adjustment. The net weight of the machine is approximately 475 pounds.

Fretter Tube Cutting Machine

The Leonard Machine Works, Baltimore Ave. and Hirst St., Lansdowne, Pa., is now building and marketing a machine that cuts pipe or tubing into a number of pieces at one operation. The machine is known as the Fretter tube cutting machine, the operation of cutting being performed by bringing the stock into contact with a set of rotary cutters.

The cutters are adjustably mounted on a horizontal shaft which is driven through double back gearing by a pulley. The cutters can be removed from the shaft for replacement and the entire shaft can also be readily removed from the machine. The sharpening of the cutters while in place on the machine can be performed by means of a portable electric grinder.

The machine table has a dovetail groove in which are placed a number of tube rests. These may be placed to correspond with the positions of the cutters. The table height can be adjusted to suit the diameter of the tube and the wear of the cutters by means of a handwheel. The table is raised by means of a cam mounted on a shaft at the bottom of the machine, the cam being rotated through one revolution when a clutch is tripped by a pedal.



Fretter Tube Cutting Machine

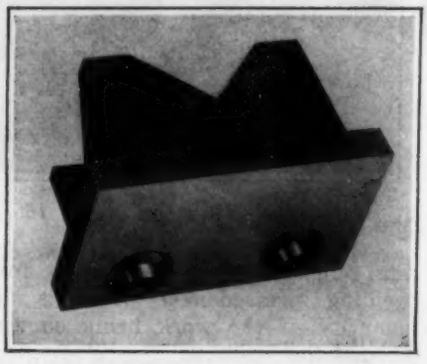
The camshaft is driven from the main drive at the top of the machine through chain and spur gearing. Long bearing surfaces are provided at each end of the table so that it will work freely up and down. In operation, a long tube is placed on the table and a pedal that controls the work stop is operated. The clutch pedal is then depressed.

The cut pieces of tube are pushed out by the entering tube. The machine has sufficient capacity for tubes with an outside diameter of 2½ in. and a wall thickness of $\frac{3}{16}$ inch.

Crescent V-Type Work Support

The Crescent Engineering Co., 404 Conway St., Baltimore, Md., is now marketing an all-purpose V-block fitted with locating pins. The device can be used on a drill, layout table, or in connection with the slots in the table of any machine tool.

The locating pins are made of tool steel and are hardened and ground.



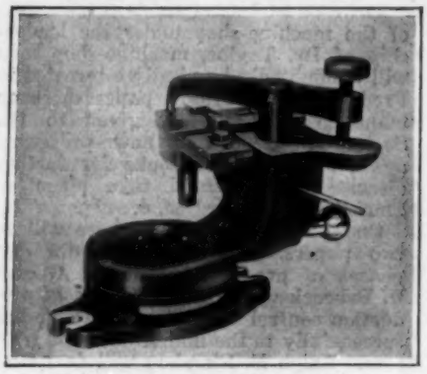
Crescent V-Type Work Support

They can be let down to the position shown in the accompanying illustration with an ordinary screwdriver. They are held in the extended position by spring pressure and can be pushed into the body of the block and locked in position quickly. With the pins up, the V-block can be used anywhere in the usual way.

The blocks are made in three types, designated V-99, V-100 and V-101. They will accommodate rounds from $\frac{3}{8}$ to 3 in. in diameter, and blocks for work of larger diameter can be furnished. Some of the types are made with the pins off center to allow the edges to be squared with a table or plate that is machined.

Davis Universal Cutter Grinding Attachment

For regrinding the cutters used in Davis boring tools, the Davis Boring Tool Co., 3730 Forest Park Blvd., St. Louis, Mo., has recently placed on the market a cutter grinding attachment, shown in the illustration herewith.



Davis Universal Cutter Grinding Attachment

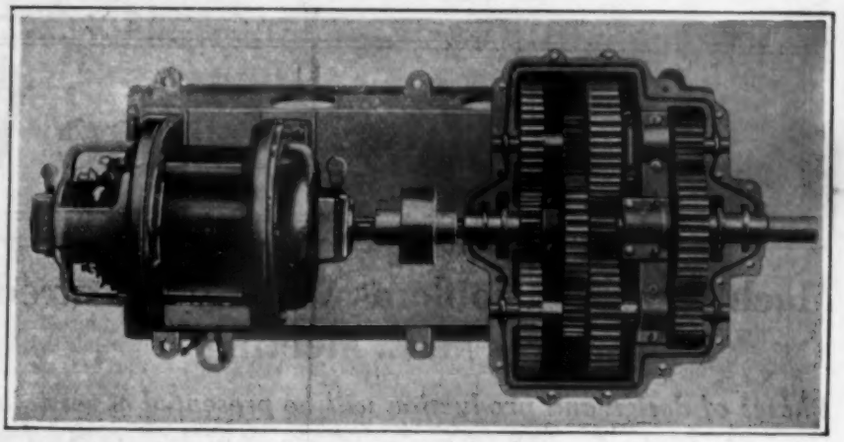
The fixture consists of a base, by which the fixture is clamped to the machine table, and an upper section to which the toolholder is attached. The tool is located against two adjustable stops and is held in position by a clamp with a thumbscrew in the end for obtaining the necessary pressure. The bottom face of the upper section is faced on an angle, with the result that the tool is always set at the proper angle to grind clearance accurately.

The attachment can be applied to any ordinary cutter grinder, and the cutting edges and corner-radius can be ground with the correct amount of clearance and rake, without the use of a bevel protractor or special gage.

Huron Speed Reducer

Huron Industries, Inc., Alpena, Mich., is now marketing an addition to its line of power transmission equipment in the form of a three-shaft, balanced-drive speed reducer. In the accompanying illustration the apparatus is shown with the cover removed and mounted upon a baseplate with the driving motor.

A semi-steel housing incloses the gears, the cover being bolted to the lower section and the joint machined and grooved to prevent loss of oil. The gears are steel and the shafts are mounted in bronze bearings and bushings. Full bearing support is furnished by the addition of a bridge wall in the lower housing.



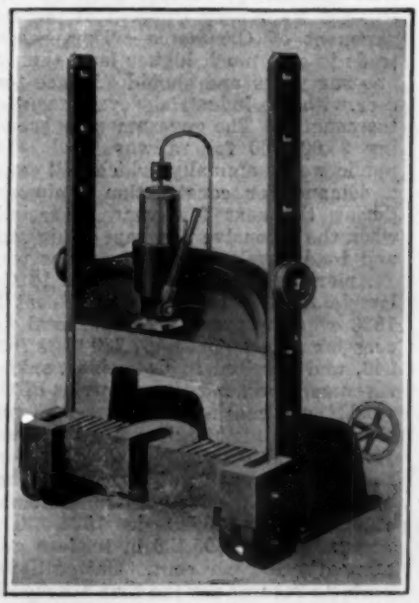
Huron Speed Reducer

An oil compression reservoir is located in the bridge wall and forms part of the force-feed lubrication for the mechanism. Oil is drawn from the casing by a pump that is driven by an eccentric on the low-speed shaft and is forced into the reservoir. From the reservoir the oil passes into the main bearings where it enters the hollow shafts through radial openings. The oil then travels through the shafts and is distributed to the wearing surfaces of all bearings by similar radial holes. For the main bearings in the casing, ring oilers are used.

If required by the service, a thrust bearing may be installed on the driven shaft. It is incorporated within the casing and distributes the thrust stresses to the bearing wall and housing. The mechanism can be furnished with or without shaft coupling and baseplate.

Watson-Stillman Vertical-Horizontal Press

An unusual design of hydraulic press for general shop use is a recent product of the Watson-Stillman Co., 50 Church St., New York, N. Y. The machine has a capacity of 60 tons and combines in one unit a vertical press for forcing, bending, straightening, pressing, etc., together with a horizontal press for all operations ordinarily done on such a press.



Watson-Stillman Vertical-Horizontal Press

The press is shown in the accompanying illustration, as arranged for vertical work, and it can be converted into a horizontal press by rotating the handwheel at the side of the machine. The change from the vertical to the horizontal position may be made without the use of crane or jack on account of the way in which the parts are balanced. In the horizontal position the abutment beam may be moved out a maximum distance of 7 ft., a four-wheel truck being provided to support the beam in the extended position and permit easy handling.

Hydraulic pressure is used only for the high-pressure stroke of the ram, the idle portion of the forward stroke and the return movement being actuated by means of a hand-operated pinion that meshes with a rack in the ram. This rack and pinion device is of sufficient power to make the use of the press for light arbor work possible without hydraulic power.

The machine is usually furnished with a hand pump and the necessary gages and connections, and it may also be operated by a small two-plunger power pump. The bed of the press is planed smooth and the forming tool on the end of the ram is supported on the bed.

News of the Week

Machine Shop Problems Will Be Featured at A. S. M. E. Meeting

Phases of design and production will be presented at sessions

Subjects of more than passing interest to machine tool engineers will be presented at the forthcoming meeting of the A. S. M. E. to be held in New York Dec. 1 to 4. The attention of members of the Society is drawn particularly to the fact that the first day of the meeting has been set aside for Council Meeting, Local Sections conferences and technical committee meetings. The technical sessions start Tuesday morning, Dec. 2, and will last through Thursday afternoon. While the program is well balanced in that it touches on all phases of mechanical engineering, it is particularly noteworthy in the fact that there are several strong sessions with papers of importance and value to members of the Society who are interested in the engineering problems of the machine shop.

On Tuesday morning the session devoted to research in machine design and operation will furnish the opportunity for the presentation of various methods of measuring hardness. J. O. Keller, the author of the paper, spent the summer in a series of investigations in which he made hardness measurements by the various known methods, tensile tests, machineability tests, and magnetic analyses of pieces of the same material subjected to different heat treatments. His results will include a report of measurements by the Herbert pendulum hardness tester which is a comparatively novel device in this country. At the same session a Research Committee on Metal Springs will present a progress report. Although this Committee has been organized for a short time it has set up a program and is ready to seek financial support for its research.

General Sessions

At the general session on Tuesday morning R. Eksergian will present "A Mathematical Analysis of Strength and Proportions of Wheels, Wheel Centers, and Hubs." This paper will bring a large amount of valuable data to the designing engineers.

On Tuesday afternoon there will be a session devoted to general machine-shop practice with papers on the effect of inaccuracies of gear teeth, on mechanical springs, and on ruling line standards by the application of light interference. The paper on inaccuracies in gear teeth was prepared as a Thesis at Leland Stanford University by L. J. Franklin and Charles Smith. J. K. Wood, who wrote the paper on mechanical springs, is chairman of the Special Research Committee on this subject and in the paper he presents the results of long experience in designing springs and gives four new formulas for this purpose. The last paper at the session by C. G. Peters and H. B. Lewis is a joint production of the Brown & Sharpe Manufacturing Co. and the Bureau of Standards.

On Wednesday morning an excellent collection of papers on the Theory of Lubrication will be presented. Lt-Comdr. L. N. Linsley, U.S.N., will present the results of an investigation of critical bearing pressures which he made while taking graduate work at Johns Hopkins University. H. A. S. Howarth's paper on Journal Lubrication is a supplement to the paper he presented at the 1923 Annual Meeting. Louis Illmer's contribution on High-Pressure Bearing Research completes the session.

As the early work in the development of management science was a product of the machine-shop under the leadership of Dr. Taylor, machine-shop men will undoubtedly be vitally interested in Frederick W. Taylor's paper on shop management originally given to the Society in 1903 and now presented again by Morris L. Cooke for further discussion. This will take place on Thursday morning, Dec. 4.

On Thursday afternoon there will be two papers which treat of different phases of production control. George D. Babcock will state principles of production control which he has applied so successfully to the manufacture of tractors. Ralph E. Flanders will deal with "The Design, Manufacture and Production Control of a Standard Machine." In his work Mr. Flanders has been dealing with the problem of reducing manufacturing overhead expense under conditions of fluctuating rates of production.

An innovation at the coming annual meeting is the insertion of two lectures, one on Tuesday afternoon at 4.30 o'clock and one on Thursday afternoon at 4.30 o'clock. The Tuesday lecture will deal with an economic question of interest to engineers and the Thursday lecture will be an interesting presentation of scientific research also of interest to the engineering profession.

Colombia Now Buying More of Our Machinery

The steady and gradual expansion of the machinery market between the United States and Colombia has been featured by increased sales of industrial machinery, according to the Industrial Machinery Division of the Department of Commerce. The present trade is at a much higher level than in pre-war years and should advance further with the industrial development of the country. The government is spending $5,000,000 for railways and other public works annually, which will cause a demand for construction equipment during the next few years, especially when the extensive program of highway and road development gets under way.

American machinery exports to Colombia increased about 16 per cent in 1923 over the preceding year, total figures jumping from $1,537,239 to $1,792,940, and resulted in Colombia ranking seventeenth among the countries of the world as a market for American machinery, leading Belgium, New Zealand, Holland and Italy.

American exports of construction and conveying machinery to Colombia amounted to $50,591 in 1922. This amount rose to $95,159 in 1923—a gain of nearly 100 per cent. United States customs returns for the first six months of 1924 indicate that orders for construction and conveying machinery are still increasing.

Recent developments in the petroleum industry at Barranca Bermeja on the Magdalena River have resulted in increased purchases of oil well drilling apparatus and other oil well machinery. The United States exported oil well machinery valued at $206,785 in 1922. This figure rose to $270,366 in 1923. Oil well equipment valued at $177,875 was shipped to Colombia from the United States during the first six months of 1924, indicating a probable increase over returns for the year 1923.

Increase in Power-Generating Machinery

Exports of power-generating machinery, except electric, from the United State to Colombia increased approximately 15 per cent in 1923 over the preceding year. A greater demand for stationary steam engines, boilers, and internal combustion engines was the leading factor in this increase. Sugar mill machinery exports from the United States increased from $42,961 in 1922 to $47,243 in 1923, and to $38,742 for the first half of 1924. Flour and grist mill machinery purchases increased over 100 per cent in 1923 over the preceding year—advancing from $96,118 to $199,589. Customs figures for the first half of 1924 indicate that this gain is being maintained during the current year.

Conference Board Undertakes Survey of the Engineering Profession

Preparing better methods for meeting future technical needs

The National Industrial Conference Board has commenced the important task of investigating in the chief basic industries of the country how engineering education may best be adjusted to meet industrial needs.

The board estimates that American industry may need 400,000 more persons for this type of responsible position in 1930 than it used in 1920. This is based on the increasing ratio of administrators, supervisors and technical experts to the total number gainfully employed in industry, as detailed in the United States Census of Occupations.

The board has selected for specific study 10 or 12 major branches of American industry in order to find what technical men are now in industry, what positions they occupy and what are their activities, what further opportunities the industry offers for additional employment of technically trained men, and in what respect the technical colleges may adapt their programs to the practical requirements of industry. The situation in each industry is being studied separately.

The board has now completed the first two of the series of investigations covering the rubber and the pulp and paper industries. Seventy-five companies co-operated with the board, covering 113 plants, over 100,000 employees and representing more than 83 per cent of the rubber industry. The board finds that of the total number of employees, 7 per cent occupy important positions, and that of these 7 per cent 23 per cent are college graduates.

In the paper and pulp industry, in which 150 companies, representing over 35,000 employees, co-operated with the board, it was revealed that a little more than 7 per cent of the men employed held executive or other important positions, and that of these, 22 per cent were college graduates, 13 per cent being graduates of recognized technical colleges.

Practice and Theory

One of the problems existing in adapting college graduates to responsible positions in industry is the difficulty of obtaining practical experience in line with theoretical instructions. Several possible ways of accomplishing such an end in some measure are indicated in the reports, such as summer employment and the co-operative college course, and it was found that very few of the companies offer such opportunities to technical college men.

The problem of selection of employment by the college graduates and of men for employment by the companies was canvassed. This showed that quite a considerable number of men—about 60 per cent of the total—had made a conscious choice of the rubber industry as a field for employment. On the other hand, by far the greatest number of college men reported entered the paper industry because of secondary reasons rather than because of any particular interest in or unusual ability for it. In both industries, the companies have so far developed very little in the way of systematic method or in the way of selecton of technically trained men for employment and development in the industries.

When the entire series is completed, the findings will be analyzed and compared and published by the board in a composite report on "Technical Education and American Industry." In that report, specific points will be discussed at length and complete sections devoted to each of the industries previously summarized.

A study of the textile industry will be the next in the series, and surveys of the metal trades, chemical industry and automotive industry are in preparation. The board points out that the gratifying co-operation on the part of industrial executives is ample evidence of the importance with which industry regards this problem.

Expansions Planned by N. C. R. Co. of Dayton

The National Cash Register Co. of Dayton, Ohio, is planning a wide expansion of its plant and manufacturing facilities. Exceedingly large business this year and expectations of increases in 1925 necessitate extension of the company's plant, already one of the largest in the world.

"For 41 years the National Cash Register Co. has been in business, and here in a Presidential year we have received the largest October business in our history," said Frederick B. Patterson, president. "Incoming orders were $355,575 ahead of any previous October. Including foreign business October represented the largest month's business the company has ever executed.

"Month by month business increases. Our sales force sending in orders has been keeping every machine in our factory working to the limit of its endurance. Our 7,000 employees can hardly keep pace with the demand. We must have more room, new buildings, more machinery, greater floor space. Our 1925 program will keep National Cash Register in the very forefront of American industry."

Eye Injuries Costly to Employers

Injuries to the eyes of workers cost employers in New York State more than a million dollars during the year ending June 30, 1923, the last year for which statistics are available. This is revealed in an analysis of workmen's compensation cases received by the National Committee for the Prevention of Blindness from the State Department of Labor.

The report shows that there were 602 cases of permanent injuries to the eyes of employees; that these injuries resulted in 54,000 weeks of disability; and that $992,705 in compensation was paid to the victims. In addition there were 12 cases of combined eye injuries and face disfigurement which resulted in 1,439 weeks of disability and for which $27,855 compensation was paid. More than 800 additional cases of injuries to the eyes resulted in temporary disability and the payment of compensation for lost time. The compensation paid for permanent eye injuries in New York State, according to this analysis, is approximately one-eighth of the total amount of compensation paid for all non-fatal injuries in the industries of the state.

Buckingham Outlines Inspection Methods

The Cleveland Section of the American Society of Mechanical Engineers held a successful meeting Monday Nov. 3, when Major Earl Buckingham of the Pratt & Whitney Co. emphasized the fact that good inspection should be a preventive and not a cure. Far too many plants make the mistake of allowing processing to proceed without inspection until the last operation has been completed when a faulty piece will mean a complete loss throughout the whole fabrication, he stated. Processing inspectors constantly checking up on the work as it goes through the machines will do much to put a stop to losses which are found too late, sometimes with an additional embarrassment to the production schedule, Mr. Buckingham declared.

Drawings are the laws laid down by the engineering department, the speaker pointed out, and these should be adhered to rigidly by the inspection people and there should be no secret understandings as to any further allowances than those stated, as this would be destructive of the morale of the shop. There should be, however, the closest kind of co-operation between drawing office, tool department, inspection, and the production departments to ensure a satisfactory piece of work going through in the first place rather than having constant mistakes arise to be discovered as inspection proceeds, Mr. Buckingham said and continued that the tool room is a particularly valuable aid in seeing that the proper gages are made to check up as the drawings are intended to be, and drawings should give as wide tolerances as are possible consistent with resultant quality.

The standards outlined in the S.A.E. Handbook were outlined at length by Major Buckingham, and in the discussion there were numerous references to the work being done by the Engineering Standards Committee. This discussion brought forth some interesting features concerning the gaging of holes to very fine tolerances. It was suggested that as it was almost impossible at times to gage to a dead fixed dimension a process of selective inspection or perhaps selective assembly should be used. It was pointed out that this is already being done in the ball and roller bearing industries where very fine limits are worked to.

Germany's Need of Machine Tools

Her economic recovery dependent on thrift and the adoption of new production methods—Necessity of overcoming aversion to German credits—International discounting bank suggested

By Our Berlin Correspondent

DURING the first days of January, 1924, soon after Germany awoke from the nightmare of inflation, the import embargo on machine tools was lifted. This event passed almost unnoticed. A limited number of American tools had found their way into Germany, even while the embargo was still in force on the strength of special licenses granted for specific needs. This number was composed almost solely of a few types of single purpose machines, like the Gleason bevel gear generator, gear grinders, and similar machines, which could not be obtained in Germany.

The only conspicuous result of re-established free importation was that machine tool dealers and a number of shop superintendents started to peruse the *American Machinist* with a little more than idle curiosity. Truth compels me to say that this was not done with any degree of zeal, but rather as a matter of duty. Although the question whether or not the American machine tool industry had, after almost a decade of Germany's isolation, anything to offer, in the way of business opportunities and useful new machinery, seemed a foregone conclusion in the negative sense, it had to be investigated at least, by the advance guards of industrial progress, as a matter of business routine if for no other reason.

On the whole, the German engineering world was convinced that the domestic machine tool industry was fully abreast of the times, in design as well as quality, even a little ahead as regards the latter. The conviction was prevalent that the American machine tool manufacturer had nothing to teach his German brethren and if there was a type developed in America not to be had in Germany for the present, that it could be obtained after a little while, ably copied and possibly even improved upon any way, at a much lower price.

The Machine Tool Industry

The German machine tool industry felt absolutely safe within its precincts, import barriers or none, unlike the automobile industry which is trembling at the thought of impending free importation.

A change has taken place since then, not very marked on the outside, but clearly visible to close observers. Since the early spring of the current year the German manufacturer has realized that the inflation booms were a hoax and the easy underbidding of all foreign competition not a result of economic production, but of a set of conditions that will never recur. At the same time the American automobile made its appearance in Germany, sold at prices which, German manufacturers declared, would not cover their cost.

This gave people something to think about. The simple means of explaining the suddenly discovered shortcomings of the German machine building industry, manifesting themselves more and more clearly as the era of stable currency advanced, by the laziness of the workmen alone, was gradually losing the power of conviction. It was argued that if American manufacturers of motor cars, even the smaller works corresponding in size with German works, could produce automobiles at prices so much lower than German manufacturers could offer, something must be materially wrong, something more than diminished efficiency of the German machinist could explain.

American Autos as Examples

The few American motor cars traversing the roads of Germany have probably done more toward dispelling the pride of German manufacturers and engineers in their achievements and the illusion of their superiority than anything that could be said or written. The automobile is one of the most prominent products of modern machine building and no doubt the best advocate for the quality of the tools by which it is produced. As such the American automobile has done wonders toward a dawning realization of respective strength.

Such realization is now only in its first stages. By far the majority of Germans still cling tenaciously to the notions that the overwhelming demand for German products in inflation times has inspired. The number dissenting, however, is increasing from day to day. Among them one finds a large percentage of people who are becoming firmly convinced that Germany needs American machine tools with all the spirit that is behind them. They are realizing that Germany of today is greatly different from Germany of pre-war times. The new generation that has risen during the last decade knows nothing or very little of economy. The strictest economy is now considered imperative and everybody can be seen to be retrenching along that line, clearly, however, without any sure instinct, but more or less groping in the dark. Attempts are made to eliminate the lavishness of past years in the same spirit that prompts the man to smoke in a string in order to save matches.

Still more pronounced and more serious is the attitude of Germany of today toward things new. It can be said safely that in pre-war times the Germans were the keenest and quickest to grasp new ideas and make use of them among all nations in the world and that the domineering position that Germany held was due largely to this fact. The German of today has become entirely conservative, perhaps more so than his British cousin, whose conservatism he used to deride. He is cautious and suspicious toward new things and the man who presents such to him, a *persona grata* in years past, is now a nuisance. Not more strongly can the stray sense of economy combined with the new attitude toward departures be illustrated than by the expression one hears so often, "Germany is now too poor to be progressive."

If the Germans adhere to this idea the country will, of course, always remain poor and become steadily poorer. Germany needs a good dose of self-analysis and some money to take the consequences. No doubt both will be forthcoming in time. The German is of an analytical disposition and if once the rosy vapor that the hothouse temperature of inflation times has caused, has been dispelled, he will go at it mercilessly and with the thoroughness for which he is reputed. Further, there can be no doubt in regard to the money, because German industry, after all, is a good investment, even if it may seem poor today.

When this time comes, and indications seem to point that it is near, Germany will again be a market for American machine tools, perhaps more so than it was immediately prior to the war. This is a fact that no unbiased observer is doubting.

Having now dealt with the German side frankly and openly, I may be permitted to look with equal frankness to the other side. The fact is that if the Germans are now gradually realizing future possibilities with regard to the import of American machine tools, the American manufacturers seem to be very far from it.

Our Own Shortcomings

Overtures from German dealers have received but scant encouragement. A few of the most progressive dealers of the younger generation have gone to the States but come back rather disappointed. The American manufacturer should take note of their names because they will doubtless be the men to do the business of the future, since most of the old well-known firms have engaged in other lines of interest. The impression has been received in Germany that the American machine tool industry has no more interest in the German market. The best that could be heard in reply to German overtures was something like, "Go ahead and sell, at cash against shipping terms; beyond that we will not commit ourselves." This is not the spirit in which a market can be re-conquered, especially under the peculiar conditions that it is in, at least for the present.

It must be said that right now American machine tools could be sold in Germany in numbers which even people used to good-sized business would notice. If one can trust reliable information, business has been refused by American manufacturers over the ques-

tion of cash payment in numerous cases. Bills of three months running of firms ranking among the highest in Germany, endorsed by reliable banks, in lieu of cash payment, have been repudiated. Such bills would on the strength of the signatures they bear be considered gilt-edged securities over here.

It is by no means too early for American machine tool manufacturers to establish agencies in Germany. For the rest, a suggestion offers itself. As American sellers require cash payment which German buyers find it hard to comply with, a financing organization may perhaps be formed in the states in which German banks would no doubt co-operate, taking some share of the responsibility. Such organizations should cash bills of responsible German manufacturers. At the rate of interest usually paid over here such a financing organization should be able to make a handsome profit.

This suggestion is not new. Such organizations have been formed in England and France for the export of automobiles to foreign buyers on the installment plan in countries like Denmark and Poland. No doubt, what the French and British motor car industry can do, the American machine tool industry can do also.

In summing up, the following must be said: Germany is open to the American machine tool industry and she needs its products. The question is whether the American manufacturers will sell their tools to German users in quantities or are content to sell a few of them to the people over here who take them apart "to see what makes them work." It's up to the American manufacturers to decide.

Mr. Estep's Speech Was Incorrectly Quoted

In the issue of Oct. 23, pages 674 b and c, in our report on the convention of the American Foundrymen's Association at Milwaukee, Wis., misstatements were made concerning the address of H. Cole Estep of Cleveland, Ohio, chairman of the A. F. A. Committee on International Relations. It was said that Mr. Estep's paper referred to the relation of American foundries to production of war materials and to formation of a defense organization.

Following is a brief abstract of Mr. Estep's paper:

"In the six years since the armistice there has been a great quickening of mutual interest among foundrymen throughout the world. Not only has the foundry industry of the United States been brought into closer contact with that of Europe, but European foundrymen have become better acquainted with each other. This situation is the result of efforts in which the American Foundrymen's Association has taken a prominent part. In this paper the author endeavors to trace the growth and effects of the international movement among foundrymen since the war. The influence of European foundry practice on America is discussed, as is that of American practice on Europe. From Europe, the United States has received the gift of skill, in return for which we have to offer a new conception of quantity production allied with the highest standards of quality. These two major influences are discussed in the paper, which also points out the value to the industry of the arrangements which have been made for exchanging papers with foreign foundrymen's organizations. The development of other forms of international contact is commented upon, with the conclusion that the growth of international understanding is not only beneficial to the castings industry, but a factor in promoting world peace."

Diesel Engines in Ocean Liners

The spectacular happenings of the war and post-war periods have obscured a silent revolution in shipping which has been going on in the last fifteen, and especially the last five years, says E. G. Gregg, Chief of the Transportation Division of the Department of Commerce in the current issue of *Commerce Reports*. The exporter has been so absorbed with the dramatic boom in 1919, the sudden collapse in 1920, and the slow and painful recovery of trade in the last four years that he has given little thought to the details of shipping. He has been conscious only of the severity of competition abroad and the high expenses at home. He has even been inclined to say that high ocean freight rates are keeping him out of desirable markets, when as a matter of fact according to Mr. Gregg, the decline in ocean rates has been greater than the decline in prices.

Unseen, except by the careful observer, a force that should cause world trade to increase has been at work. This force is the motorship which by reducing the cost of carriage by sea, is stimulating oversea trade.

The motorship in general is today the most efficient ocean transportation unit. Although a new motorship costs approximately 25 per cent more than a steamer of similar size, it can carry goods from 10 to 30 per cent cheaper.

Big Strides Made

The first small sea-going motorship was constructed in 1910, and the first large one in 1912. Since that time, in spite of the fact that four war years intervened in which construction was limited largely to standard designs of steamers, motorship tonnage has increased to 1,700,000 gross tons. Of all the ships under construction in the world today more than one-third are to be equipped with Diesel engines. This large amount of motorship tonnage in active employment has a distinct tendency toward keeping ocean rates down.

The most recent development in motorship construction is in the field of the large passenger ship. Heretofore only cargo boats and small passenger-cargo ships have been equipped with Diesel engines; but in the past year, two passenger ships, averaging around 20,000 gross tons each, have been ordered and are now nearly completed. Necessarily, engine designs have had to be changed to develop the enormous power for driving a 20,000-ton ship at a speed of 17 knots. The double acting type (with an impulse on each side of the piston) has been successfully designed and constructed. While large power installations for high speeds are not entirely faultless, it is reasonable to assume that the Diesel engine has made an entry into the most difficult marine field, the express passenger service in the North Atlantic.

Considerable interest in motorships has been shown by American shipping companies, and a number of vessels of this type have been built for private American shipowners. All the leading shipyards in this country have developed types of marine Diesel engines or are building them under license from leading European companies. The last session of Congress appropriated $25,000,000 to enable the U. S. Shipping Board to convert about 50 of its better class steamers to Diesel propulsion.

England May Revive the McKenna Tariff

With the return of the Conservatives to power in England there is a strong possibility of the McKenna duties on automobiles and other articles being restored, according to John N. Willys, president of the Willys-Overland Co. who returned home on the Majestic recently.

"These duties may not be as heavy as they were. I think, however, a duty will be placed on American-made cars. Our own business is progressing very satisfactorily and the outlook is very bright with us. We should export more than 20,000 cars by the end of the year."

Second Week of Record Freight Loading

A new high record in the number of cars loaded with revenue freight was established by American railroads in the week ending Oct. 25, according to an announcement made by the Car Service Division of the American Railway Association. The railroads loaded 1,112,345 cars, eclipsing by 10,009 cars the previous high record established in the preceding week.

The freight was successfully handled by the railroads, the announcement states, without transportation difficulties and without car shortage, there now being nearly 95,000 surplus freight cars in good repair and immediately available for use when needed.

Mercedes and Benz in Merger

An announcement has been made in New York of the merging of two of the largest automobile concerns in Germany. They are the Mercedes Automobile Co. and the Benz Motor Works Co. It was stated by American representatives of the corporation that the merger means the beginning of standardization of the automobile in Europe.

Officials of the Mercedes company recently visited America with a view to making arrangements to purchase all of the needed raw material in this country.

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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BOTH in anticipation and realization the election has been acclaimed as the harbinger of prosperity. The press has published interviews with many men of prominence who all agree in predicting good times.

The head lines in one paper described the stock market of Saturday, Nov. 1 as "Boiling up in joyous anticipation of Coolidge's election." The report of the succeeding Monday, Nov. 3, stated that "Stock prices were strong on eve of election," and an evening paper of Wednesday, Nov. 5 announced that "Stocks advanced strongly in unusually active trading."

But these optimistic generalizations were hardly borne out by the record, which shows that on Saturday, Nov. 1, 361 issues traded in advanced an average of 0.25 per cent; Monday, Nov. 3, 474 issues traded in advanced an average of 0.023 per cent; Wednesday, Nov. 5, 501 issues traded in advanced an average of 0.56 per cent.

This is an average improvement of less than 1 per cent in the three days during which the election and its consequences were uppermost in the public mind. On Thursday, when the political excitement had subsided the heading over the stock market report in an evening paper stated that "Industrials reflect a tendency to take profits, with several specialties weak." Railway shares were logically benefited by the overwhelming defeat of LaFollette whose platform favored a radical reduction in rates with Government ownership as the ultimate goal.

The Republican victory is construed as an emphatic rejection of these proposals and with good rates and the large traffic they are enjoying it is rightly argued that the railroads have a long period of prosperity ahead of them. Upon this theory their securities are being heavily bought by capitalists of experience and it is quite possible that some of the low priced shares may double or triple in value before the present movement comes to an end.

But of the industrial stocks and the commodity markets in general it is not possible to speak so positively. Capital feels more secure because radicalism has been defeated, but this feeling of security will not increase the buying power of the wage earners that are unemployed or give elasticity to the incomes that are already strained to the breaking point by the high prices at which the necessaries of life are selling.

It is too soon to judge whether we shall see greater industrial activity as a result of the election. The prices for iron, steel and copper have been marked up slightly, but the demand is about as it was some weeks ago and there are no indications of an increase in building construction.

What's Doing in Industry

Very definite improvement has been noted in the machinery and machine tool trade throughout the United States during the past week, much of it being of the pre-election variety. Since the election indications are that sales will be much improved not only to the railroads, locomotive builders and freight car manufacturers, but to general industrials as well. With the railroads doing a record business and no legislative changes anticipated, equipment will undoubtedly be further improved, which, of course, means the further purchasing of all kinds of machinery and tools.

Buying has been reported from the automotive centers and some inquiry from the motor car builders has been received. It is expected that this business will develop before the first of the year and that next year's trade from this source will be better than that of this year.

Wall Street had a busy week with records broken as to the volume of sales and the number of issues traded in. Prices generally increased, the rails in the lead, as was to be expected.

The textile mills are somewhat busier, although cotton and cotton goods are a little lower as a result of increased estimates of the cotton crop and everyone who deals in wool and woolen goods is being made careful by the high prices that the raw material is bringing. The result is a persistence in the hand to mouth buying policy which bespeaks a lack of confidence in the present level of values and, although stocks are low, no one seems willing to increase them.

The automobile dealers are said to be happier because the Western farmers are buying the many used cars that have accumulated, and in the oil business it is reported that the Lions and the Lambs are working in harmony to restrict production and reduce stocks.

But all this is routine news that is of no significance except as it indicates that business men have stopped talking politics and are getting back to work. By Thanksgiving it will be possible to gage the future more accurately. If by that time there is a job for everyone and everyone is on his job the good times the politicians have predicted may materialize, but mere talk will not evoke prosperity and it is unwise to pay too much attention to it.

Meantime money continues easy. The weekly statement of the Federal Reserve System gives no indication of an advance in rates and it has been announced that gold will soon be exported to cover the proceeds of the German loan recently floated here. Other foreign loans are in process of negotiation and it is plain that Europe will continue to borrow here as long as America is willing to lend. This is perfectly natural and if they are well secured no objection can be made to these foreign loans provided they do not restrict our markets or foster a competition that we cannot meet without cutting wages to the European level.

The free traders may argue as they choose about the fluidity of capital, but the recent election shows that the American people are unalterably in favor of protection and if they discover that American capital is being exported to build up foreign industries with which they cannot compete they will find a way to keep their money at home. Even free trade England has been a protectionist in controlling its capital in the interest of its nationals and it is not to be expected that the United States will ignore the example thus set.

The question will doubtless be discussed at length when Congress reconvenes in December, and meantime it seems unlikely that American business will run away while it is confronted with the possible loss to Europe of the foreign customers that it has supplied during the last five or ten years.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Detroit

A slow but steady improvement in the machine tool and machinery field in Detroit is being felt by most of the leaders in the industry in Detroit and the smaller industrial centers around this city.

Clearing of the general business atmosphere which has been somewhat clouded has set in, and Detroit is experiencing the steady advance in production in all factories which has been hoped for during the past two months.

Sales of machinery appear to have reached a more steady point. Whereas they were spotty a month ago, they have settled to a fairly uniform mark. Special machinery is being purchased by some of the larger industrial firms, but the demand for standard equipment from the smaller plants has been as large in proportion.

Local dealers are agreed that the worst of the business depression is past, and they anticipate increased sales during the last two months of the year. Some are frank in saying that they hope that they can break even or a little better for the year.

Recent financial statements bear out the impression that Detroit's automobile row will be hitting top stride in production within a very short time. More attention is being given to the development of foreign markets than at any time in the industry's history. Some eight or ten motor companies report larger sales for 1924 than for last year which established a new record. Slightly more than half of this year's production will be Fords.

Heavy movements on railroads are reported throughout Michigan, and general conditions all over the state are growing better.

Cincinnati

Machine tool manufacturers in Cincinnati are gratified at the upward trend that production has taken in the past few weeks. Orders are on the increase, inquiries are more brisk, and there is a general feeling in the industry that better business is just ahead. The volume of production that is being handled locally at present is probably the largest of the year and compares most favorably with the corresponding period in 1923, in most instances running ahead of last year.

One of the largest of the plants is engaged in building especially designed machinery for paper mills and the contract under which it is working is a large one, keeping the plant operating on a heavy schedule. Railroads have been in the market lately and have placed several good orders for heavy machinery. Railroad lists are larger than they were and the roads have been opening up to some extent in their purchasing. Automobile manufacturers are not taking a great deal of machine tool equipment at the present moment, confining their orders to replacements.

The demand for lathes is on the increase. Inquiries have been good and sales have increased in the past few weeks to a considerable degree. The same is true of planers which are being ordered more freely than they were. Electrical tools are improving in sales, according to several large Cincinnati manufacturers. These manufacturers state that the automotive field is still absorbing probably more of the electrical tools produced than any other one industry. Wood-working machinery production shows no letup and orders are being booked in sufficient quantities to keep local manufacturers operating at normal capacity for some time to come.

In the used machinery field there has been a gradual increase in the demand for light machinery and small tools. Cincinnati concerns state that their business in used machinery has improved since the middle of October and is better now than it has been for some time. Foundries report that they are in better shape and have increased their operations slightly.

Cleveland

Machine tool builders in the Cleveland district are preparing to enter upon a new era of prosperity. While the more conservative elements in this field are prone to look for a gradual revival of business, the better results not to be expected before the beginning of the new year, in the main the manufacturers and distributors operating out of the Cleveland territory assert that immediate results can be looked for.

Indicating the general trend, orders for planers have not been numerous, but recently an increase has been noted. Orders are now coming from a wider territory than before which means that a steadier business will result.

New England

Connecticut machinery manufacturers are feeling the force of improved business conditions in Europe which is found reflected in orders recently placed and business in prospect. One of the principal industries of Hartford reports its export business to be increasing more rapidly than the domestic business. While this condition is not experienced by other manufacturers, the consensus is that the foreign trade is immediately in prospect for them. The business is fairly scattered throughout Europe.

Japan is a good buyer of machinery at this time. This buying is of the wide range of machinery made throughout New England. Labor saving equipment is heavily bought and inquiries indicate that prospective business is of even more substantial volume. There are also indications of purchases of special machinery for the adoption of American practices.

Industries are pursuing full schedules with normal working forces and, while no building expansions are contemplated, there are plans in some quarters of expanding working organizations upon receipt of orders now in suspension. Orders that are being held up are mostly for the automotive industry.

New York

Machinery and machine tool dealers in the New York district reported that business was improved this week over that of any week since Sept. 15 and that all indications point to a steady improvement from now until at least the first of the year. Railroad buying improved somewhat and the New York Central R.R. was in the market with a good sized list. Other railroads inquiring were the Lehigh Valley and some Southern railroads. It was rumored in the district that the big electric companies that have been buying steadily all year, but with no unusual inquiries, would have big lists out before the first of the year and that next year's appropriation for machinery and machine tools would exceed the 1924 figure.

Automobile accessory makers, freight car builders and radio receiving-set manufacturers were all in the market last week to a limited degree. This business has improved gradually, however, since the summer months and makes a dependable portion of the year's totals.

Used tools did not find as ready a market as has been the experience during the past six weeks and dealers did not look any too optimistically into the future.

Exporting also fell off a trifle during the past week from the New York port. Machinery and machine tool exporting has been keeping up remarkably well this year and exporters claim that it will finish the year with record figures.

Last week's unprecedented improvement in railroad shares and lines dependent upon the railroads such as Baldwin Locomotive, American Car & Foundry Co. and others, was an added encouragement for the machine tool men in all parts of the country. With the railroads doing a record business and other lines trailing along in the wake of prosperity, the machinery and machine tool industry is bound to get a good share of the spendable money, it is pointed out.

Ryerson Buys Interest in Reed-Smith Co.

The stockholders of Joseph T. Ryerson & Son., Inc., Chicago, have purchased a substantial interest in the Reed-Smith Co., Milwaukee, an independent steel warehousing company. Under the new plan, D. M. Ryerson will be president of the Reed-Smith Co., George W. Smith will be vice-president and general manager, E. L. Hartig, treasurer, and Carl Gallauer secretary.

Welding Class Formed for Employees

In line with the engineering assistance rendered to its customers through its industrial engineering department, the Air Reduction Sales Co. organized a special class of foremen, superintendents and other executives at the Airco-Davis-Bournonville Welding Institute in Jersey City, Nov. 17, for instruction on the theory and practice of the oxy-acetylene process, and the industrial phases of industrial gases, uses, application and plant distribution. Organization of new classes will be announced later.

Stewart-Warner and Alemite Merger

The merging of the Bassick-Alemite Corp. into the Stewart-Warner Speedometer Co. is expected soon, according to advices received in Wall Street from Chicago, states the *New York Times* as of Nov. 8. The formal announcement may be made within the next day or two.

The Stewart-Warner Speedometer Co. manufactures automobile accessories. The Bassick-Alemite Corp., formed in 1923, manufactures the Alemite system for high-pressure lubrication of automobiles, compressors, pumps, gasoline filters and other machinery or mechanical devices. It has plants in Chicago, Bridgeport and Meriden, Conn., and in Newark, N. J.

Obituaries

FREDERICK J. COOLEY, vice-president and manager of the Windsor Foundry Corp., Windsor, Vt., died suddenly at the Mary Hitchcock Hospital, Hanover, N. H., recently. Mr. Cooley had been active in the motor boat and motor truck industry for years and since 1918 had been in business with his brother, William Cooley. The Windsor Foundry Co. furnishes gray iron castings to machine tool builders.

JOHN T. KING, one of the founders of King & Walker, now the Wisconsin Foundry & Machine Co., Madison, Wis., died Nov. 3 following a stroke of paralysis. He was born Dec. 14, 1850, in Cape Vincent, Jefferson county, N. Y., and went to Madison in 1878.

A. G. PURCHAS, district manager of the Canadian Rock Drill Co., at Cobalt, Ontario, was badly injured in a motor accident near Haileybury, and died shortly afterward.

Business Items

The name of the Fitchburg Machine Works has been changed to the Seneca Falls Machine Co. and since Nov. 1 has been located at Senaca Falls, N. Y. Last February the Fitchburg Machine Works and the Seneca Falls Manufacturing Co. were consolidated and the move to the plant of the latter company has been advisable to obtain additional floor space and to be geographically nearer the users of the Fitchburg products. Marcus A. Coolidge is president and treasurer of the new company, Edwin R. Smith is vice-president and general manager, and John A. Fyfe is secretary.

The annual sales conference of the Howell Electric Motor Co. organization was held recently at the factory, Howell, Mich. Distributors from all parts of the United States and Canada attended the meetings which were addressed by several officials of the company.

The Zinn Corp. has been formed with a Connecticut charter and with headquarters at the present in New York City. An announcement states, "To better take care of the rapidly growing business of Simon Zinn, Inc., manufacturer of fancy metal goods, arrangements have been made with the Root Co., Bristol, Conn., to take over the manufacture of brass and other boxes for Zinn compacts and for that purpose the Zinn Corp. has been formed."

A machine shop and blacksmith shop will be built by Hodgson, King & Marble, Vancouver, B. C., Canada, in connection with the Burrard Drydock, and will cost approximately $100,000.

Morton & Weaver, machine tool makers, etc., Coventry, have dissolved partnership, but the business will be carried on as usual under the old name by W. A. Weaver.

The St. Louis Machine Tool Co., St. Louis, Mo., is offering at private sale its real estate, buildings, shop equipment and machine tool stock.

Darling Bros., Montreal, Can., have been appointed Canadian agents for the Foote Bros. Gear & Machine Co., Chicago, Ill.

The Standard Parts Co., Cleveland, that has been in receivership for the past four years, has liquidated all of its properties and is no longer operating.

The Cowan Manufacturing Co., tool manufacturer, has established a plant at 546 South Meridian St., Indianapolis.

The Harter Rolled Metal Co., of Elkhart, Ind., incorporated for $50,000, which will manufacture metal tubing, metal sections, channel irons and similar products, will occupy part of the big Engman-Matthews Range Co. building, Goshen, Ind., and will employ 75 men. Incorporators are Evan C. Harter, Martin E. Crow and Edward C. Crow, all residents of Elkhart.

The Chicago office of the Standard Gauge Steel Co., Beaver Falls, Pa., has been moved to 547 Webster Building, 327 S. Lasalle St.

The A. J. Miller Co. of Bellefontaine, Ohio, has taken over the plant of the Defiance Motor Truck Co. of Defiance, Ohio, and will start operations immediately under the name of the General Body Co.

The Hill Pump Works of Anderson, Ind., a division of the Midwest Engine Corp., has been sold to Huntile Gordon, Boston, Mass., by order of the probate court of Indianapolis. The price paid was $215,000 subject to taxes amounting to more than $5,000.

The Imperial Shock Absorber Co., Inc., Long Beach, Calif., has been incorporated with a capital stock of $250,000. The directors are: C. E. Boone, R. A. Terry and C. F. Christiansen, all of Long Beach.

The Refrigerator Corp. of America, has been incorporated in Los Angeles, Calif., with a capital stock of $250,000. The directors are: C. O. Hagen, E. B. McKnight, H. C. Mayer, L. M. Edwards and O. C. Sattinger, all of Los Angeles.

Personals

GEORGE L. MARKLAND, JR., chairman of the board of directors of the Philadelphia Gear Works, Philadelphia, and president of the American Gear Manufacturers' Association, has been elected Mayor of Stone Harbor, N. J. In addition to his trade name of "Phillie Gear" he must now be called, "His Honor the Mayor."

N. P. FARRAR has been appointed assistant sales manager of the Pawling & Harnischfeger Co., Milwaukee, Wis. He was formerly district manager of the company in its Philadelphia territory.

H. L. MODE has been appointed sales representative in the Eastern district by the Pawling & Harnischfeger Co., Milwaukee. His headquarters will be at New York and Philadelphia.

C. R. TRIMMER, formerly with the Cyclops Steel Co. and the Vanadium Steel Co., has been appointed by the Jessop Steel Co., Washington, Pa., as manager of its offices and warehouse in the Chicago district. His headquarters will be at 609-613 Fulton St.

H. E. BYER has been appointed manager of the condenser and vacuum pump sales for the Chicago Pneumatic Tool Co., New York.

HENRY M. CLEAVER, formerly works manager of the Pond Works of Niles-Bement-Pond Co., Plainfield, N. J., has been promoted to assistant to the president with headquarters in New York City.

HERBERT G. WILLIAMS, secretary of the Machine Tool Trades Association, London, S. W., has been elected a member of the new British parliament.

M. T. LOTHROP has been elected vice-president of the Timken Roller Bearing Co., Canton, Ohio.

MAURICE OWENS, formerly with the Syracuse Supply Co., Syracuse, N. Y., has been made a sales engineer of Crane - Shiefer - Owens, Inc., Buffalo, N. Y. He will be located in the Syracuse office of the company.

H. V. BERONIUS will represent the Gibb Instrument Co., Bay City, Mich., in the Iowa, Kansas, Nebraska, Oklahoma and Northwestern Missouri districts. His headquarters will be at 33 Linwood Terrace, Kansas City, Mo.

JOHN WILKINSON has resigned as chief engineer of the H. H. Franklin Manufacturing Co., Syracuse, N. Y., but will continue as vice-president of the company. Mr. Wilkinson is planning a long rest and vacation.

M. H. FLYNN has left the Hartford Valve Co. to become associated with the Billings & Spencer Co. in that city.

LANCASTER P. CLARK, formerly New York representative of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., is now manager of the metal department of the Warner Bros. Co., Bridgeport, Conn.

T. B. H. ASKIN has been appointed sales manager for the Intermountain division of the American Manganese Steel Co., Chicago Heights, Ill. His headquarters will be in Denver, Col.

CHARLES P. PARSONS will remain as factory manager, EDGAR K. STEPHENSON as foreign sales manager, and W. C. RODGER as factory superintendent of the L. C. Smith & Bros. Typewriter, Inc., Syracuse, N. Y.

R. C. BROACH has been appointed Southeastern district manager for the Heine Boiler Co., St. Louis, Mo. His territory covers eastern Tennesseee, North and South Carolina, Alabama, Georgia and Florida and his headquarters will be at 709 Glenn Building, Atlanta, Ga.

EDWARD M. WILCOX, who had been with the Westinghouse Electric & Manufacturing Co. in New York City, is now located with the Combustion Engineering Corp. in Pittsburgh.

JOHN HUNTER, who has been with the Heine Boiler Co. in St. Louis has gone into business for himself as a consulting and advisory engineer at Webster Groves, Missouri.

GEORGE F. HARMAN, formerly with the U. S. Gauge Co. at Sellersville, Pa., is located in Brooklyn with the Schaeffer & Budenberg Manufacturing Co.

JOHN OSTER, who resigned July 1 as secretary, treasurer and general manager of the Andis O. M. Manufacturing Co., Racine, Wis., manufacturing motor-driven hair clippers and other automatic cutlery, has organized the John Oster Manufacturing Co. of Racine, capital stock $50,000, to engage in the manufacture of hardware of all descriptions. Oscar Luckner and Carl Bakusen are associated with him in the new enterprise.

Pilger Is New Berlin Trade Commissioner

The appointment of Theodore Pilger of Butte, Montana, as Trade Commissioner to Berlin, Germany, was announced recently, by Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce.

A graduate of the Montana School of Mines, Mr. Pilger has had an extensive

Theodore Pilger

and varied career as a mining and mechanical engineer, sales engineer and geologist. As a member of the Commercial Attaches staff at Berlin, he will devote his attention particularly to the metallurgical situation, and will follow closely the developments in the German machinery and agricultural implements, electrical apparatus industries and allied trades.

During the past ten years Mr. Pilger has served in various capacities, as Assistant City Engineer of Butte, Montana; mineral land surveyor in the state of Montana; geologist, mechanical and mining engineer for the Butte & Superior Mining Co., general manager of gold properties in Alaska and sales engineer of the Electrical Mining, Cement and Mechanical Engineering Department, of the Allis-Chalmers Manufacturing Co., of Milwaukee.

Mr. Pilger sailed for his new post on Nov. 12.

Railroads Report on First Nine Months

During the first nine months of the current year the Class 1 railroads of the country placed in service 120,727 freight cars, a decrease of 13,909 under last year, and 1,657 locomotives, according to the American Railway Association.

Of the new freight cars installed, 15,771 were placed on order Oct. 1 was 285.

Figures as to freight cars and locomotives placed in service or on order include new, rebuilt and leased equipment.

On Oct. 1 the carriers had 49,702 freight cars on order, an increase of 8,226 over the number on Sept. 1. Of the total, 30,096 were box cars, 12,793 were coal cars and 2,666 were refrigerator cars.

Steinmetz Scholarship Is Established

The General Electric Co., Schenectady, N. Y., has appropriated $25,000 for a Steinmetz memorial fund for Union College in memory of Dr. Charles P. Steinmetz, the company's chief consulting engineer who died a year ago, President Charles A. Richmond of Union has announced. The income from this fund will be used to provide four scholarships annually.

Students in any of the courses at Union are eligible, but preference will first be given to sons of employees of the General Electric Co. and next to sons of residents of Schenectady.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Electric drills. Prague, Czechoslovakia. Purchase. Reference No. 12,074.

Air compressors, belt, steam and direct electric drive. Santiago, Chile. Agency. Reference No. 12,004.

Small air compressors for garages. Bucharest, Rumania. Agency. Reference No. 12,009.

Drilling tools, percussion and well-drilling tools for irrigation work. Johannesburg, South Africa. Purchase. Reference No. 12,002.

Electric hoists. Santiago, Chile. Agency. Reference No. 12,004.

Machine tools. Frankfort, Germany. Agency. Reference No. 12,006.

Machinery for manufacturing twist drills. Bilbao, Spain. Purchase. Reference No. 12,007.

Centrifugal pumps. Santiago, Chile. Agency. Reference No. 12,004.

Forthcoming Meetings

National Founders Association. Twenty-eighth annual convention. Hotel Astor, New York City, Nov. 19 and 20. J. M. Taylor, secretary, 29 S. LaSalle St., Chicago.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

American Association for the Advancement of Science. Meeting at Washington, D. C., Dec. 29, Jan. 1, 2 and 3. Burton Livingston, Smithsonian Institute, Washington, D. C.

Society of Automotive Engineers. Annual Meeting. Detroit, Mich., Jan. 20, 21, 22 and 23. C. F. Clarkson, 29 W. 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Definite improvement in pig-iron demand noted during week. Sales mostly in small tonnage lots. No change in iron price schedules since Oct. 31. Steel tending upward particularly in Middle West. During the past month prices have ranged between $1.60 and $1.90 per 100 lb. for plates and $1.80 to $2 for structural shapes, with bars going at $2, f.o.b., Pittsburgh mill. A year ago this time, bars were $2.40 and structurals, $2.50 per 100 lb., Pittsburgh.

Non-Ferrous Metals—Improvement continues in non-ferrous metals. Copper rose ⅛c.; tin, ⅜c.; zinc, ⅛c. and antimony ⅛c. per lb. in New York warehouses during the week. Lead, however, has shown no change since Oct. 31.

(All prices as of Nov. 7)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.55
Northern Basic	21.27
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.10
BIRMINGHAM	
No. 2 Foundry	18.00@18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.34
Virginia No. 2	29.75
Basic	21.25
Grey Forge	21.25
CHICAGO	
No. 2 Foundry local	20.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.60@2.70	3.89	3.45	3.80
No. 12	2.70@2.80	3.94	3.50	3.95
No. 14	2.80@2.90	3.99	3.55	4.00
No. 16	3.00@3.10	4.09	3.65	4.10
Black				
Nos. 17 and 21	3.25@3.35	4.40	4.15	4.55
Nos. 22 and 24	3.30@3.40	4.45	4.20	4.55
Nos. 25 and 26	3.35@3.45	4.50	4.25	4.60
No. 28	3.40@3.50	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.50@3.60	4.60	....	4.60
Nos. 12 and 14	3.60@3.70	4.70	....	4.70
Nos. 17 and 21	3.90@4.00	5.00	....	5.00
Nos. 22 and 24	4.05@4.15	5.15	3.00	5.15
No. 26	4.20@4.30	5.30	4.15	5.30
No. 28	4.50@4.60	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	¾	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	6.55
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.05	3.90	3.80
Cold drawn flats, squares	4.55	4.40	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.75c.; 5/32 to ¼, 7.25c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.25
Tin, 5-ton lots, New York			54.50
Lead (up to carlots), St. Louis	8.80	New York	9.50
Zinc (up to carlots), St. Louis	6.60@6.62½	New York	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.20	28.00	28.50
Antimony (Chinese), ton spot	13.00	14.00	10.00
Copper sheets, base	20.87½	20.87½	23.00
Copper wire, base	18.87½	19.25	21.75
Copper bars, base	20.12½	21.12½	22.50
Copper tubing, base	23.25	24.25	25.75
Brass sheets, base	17.62½	17.25	19.75
Brass tubing, base	22.00	22.75	28.25
Brass rods, base	15.37½	15.12½	17.50
Brass wire, base	18.12½	19.25	20.25
Zinc sheets (casks)	10.60	11.50	.....
Solder (½ and ½), (case lots)	38@39	34.00	30.00
Babbitt metal (83% tin)	60.00	62.50	48@52
Babbitt metal (35% tin)	28.00	19.50	23@26
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11. 50	10.50	11 00
Copper, heavy, and wire	10.75@11. 00	10.25	10 50
Copper, light, and bottoms	9.50@ 9.75	9.50	9.50
Heavy lead	6.75@ 7.00	6.50	7.00
Tea lead	5.75@ 6. 00	5.00	5.50
Brass, heavy, yellow	7.00@ 7. 25	6.75	7.00
Brass, heavy, red	8. 75@ 9.00	8.50	8.50
Brass, light	6.00@ 6.25	5.75	6.00
No. 1 yellow rod turnings	7.50@ 8.00	7.00	7.00
Zinc	3.75@ 4.00	3.75	3.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23. 50	$22. 85	$21. 00
"A" Grade:				
IC,	20x28, 112 sheets	19. 00	18. 80	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13. 00	13. 00	12 75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7. 25	6.80@6.90	6.50@6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 19	$0. 14
Cotton waste, colored, per lb.	. 09@ .14½	.18	. 10½
Wiping cloths, 13½x13½, per lb	11.00@11.25*	36. 00 per M	. 16
Wiping cloths, 13½x20½, per lb.		50. 00 per M	. 16
Sal soda, per 100 lb. keg	2. 25	2. 25	2. 65
Roll sulphur, per 100 lb. keg	3. 60	3. 25	3. 50
Linseed oil, per gal., 5 bbl. lots	1. 08	1. 15	1. 05
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	. 35	. 21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4. 86	$5. 84	$6. 48
Emery paper	10. 71	11. 00	8. 80
Emery cloth	28. 00	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag		. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 00@3. 25
Coke, prompt foundry, Connellsville	per net ton		4. 25@4. 75
White lead, dry or in oil	100 lb. kegs	New York, 15. 25	
Red lead, dry	100 lb. kegs	New York, 15. 25	
Red lead, in oil	100 lb. kegs	New York, 16. 75	

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0. 0324	$0. 0324	$0. 0354
Cold finished shafting	per lb.	.0405	.0405	.0465
Brass rods	per lb	.1487½	.1462½	.1475
Solder (½ and ½)	per lb.	.38@.39	.37@.38	.295
Cotton waste	per lb.	.14@.21	.14@.21	10@13
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.29	.29	.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	50%	40–10%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	60%
1½ and 1¼x3 in. up to 12 in	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	35%	$3. 50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	3. 50 net	60%*
Button head bolts, with hex. nuts	10%	3. 50 net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	45%	.....	65%
Square and hex. head cap screws	75%	75–10%	.....
Carriage bolts, up to 1 in. x30 in.	35%	60%	55%
Bolt ends, with hot pressed nuts	45%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4. 65
Semi-finished nuts, ⅜ and smaller	70%	.....	.....
Semi-finished nuts, ½ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6. 50	$4. 00	$3. 75
Washers, cast iron, ⅝ in., per 100 lb. (net)	5. 50	4. 00	3. 75
Washers, round plate, per 100 lb. Off list	1. 50	5. 00	4. 50
Nuts, hot pressed, sq., per 100 lb. Off list	1. 50	4. 00	4. 00
Nuts, hot pressed, hex., per 100 lb. Off list	1. 50	4 00	4. 00
Nuts, cold punched, sq., per 100 lb. Off list	1. 50	4. 00	4. 00
Nuts, cold punched, hex., per 100 lb. Off list	1. 50	4. 00	4. 00
Rivets:			
Rivets, ⅞ in. dia. and smaller	60%	60–10%	70%
Rivets, tinned	60%	60–10%	70%
Button heads ⅞-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3. 50	$3. 50
Cone heads, ditto (net)	5. 20	3. 60	3. 70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0. 15
⅝ in. diameter *EXTRA*	0. 35	.....	0. 15
½ in. diameter *EXTRA*	0. 75	.....	0. 50
1 in. long, and shorter *EXTRA*	0. 75	.....	0. 50
Longer than 5 in. *EXTRA*	0. 50	.....	0. 25
Less than 200 lb. *EXTRA*	0. 50	.....	0. 50
Countersunk heads *EXTRA*	0. 45	.....	....

*Square.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Abingdon—Sanitary Mfg. Co.—20 turret lathes.

Ia., Cedar Rapids—Cedar Rapids Foundry & Machine Co.—surface grinder and punch press, 2 in. stroke or larger.

Mass., Charlestown (Boston P. O.)—The Merchants Terminal Co., Medford St.—miscellaneous tools and equipment for garage and repair shop.

Mass., Norwood—The Board of Selectmen—metal and woodworking machinery for manual training dept. in new $500,000 high school.

Mass., Randolph—Schoolhouse Committee—manuel training equipment including metal and woodworking machinery for high school.

Mass., Roxbury (Boston P. O.)—additional equipment for new factory for the manufacture of surveying instruments.

Mass., Somerville—H. Rosen, 112 Wisconsin Ave.—miscellaneous tools and equipment for public garage.

Mass., South Boston—Lewis Shepard Co., 566 1st St., (material handling equipment)—equipment for new factory at Watertown.

Mich., Iron Mountain—Peninsula Granite & Marble Works, (monuments)—power saws and planer.

Mo., St. Louis—St. Louis Steel Casting Co., 100 Malt St., J. Teipel, Pres.—200 to 300 ton hydraulic vertical press for straightening steel castings.

Neb., Omaha—The Nebraska Power Co., 15th and Farnam Sts., Mr. Smith, Purch. Agt.—5 ton spur geared chain hoist traveling crane.

N. Y., New York—W. H. Hoepener, 959 Brook Ave.—one 20 in. drill press.

O., Columbus—Mathews Lumber & Mfg. Co., 500 South Central Ave., W. A. Mathews, Gen. Mgr.—one 36 in. sander, one gang rip saw, two 8 in. or 9 in. stickers.

O., Leetonia—Leetonia Tool Co.—13 x 40 in. Universal grinder, either Modern No. 3 or Morse No. 2.

Pa., Pittsburgh—Amer. Sheet & Tin Plate Co., Frick Bldg., M. S. Dennis, Purch. Agt.—horizontal boring mill for Canton, Ohio.

Pa., Pittsburgh—Carnegie Steel Co., Carnegie Bldg., C. L. Miller, Purch. Agt.—Four lathes, turret lathe, and planer, for Edgar Thomson Works, Braddock, Pa.

Wash., Port Angeles—The Ninemire & Morgan Lumber Co.—machinery to replace that which was recently destroyed by fire.

Wis., Hiles—C. Fish Lumber Co., Elcho—planners, band saws, etc.

Wis., Ladysmith—Schmidt Handle Co., (wooden handles, etc.)—delving machines, sander.

Wis., Madison—The Jacobson Auto Co., 207 East Washington Ave.—equipment and tools for new $150,000 garage and repair shop.

Wis., Mattoon—M. Elstad—power rip saws, band saw mills, belting, shafting, etc.

Wis., Milwaukee—Maynard Electric Steel Castings Co., Kilbourn Rd.—power moulding machines.

Wis., Milwaukee—Standard Sanitary Mfg. Co., 311 5th St.—monorail crane.

Wis., Sheboygan—C. Reiss Coal Co., South 8th and Water Sts.—coal unloading machinery for Escanaba, Mich., yard.

Wis., Waukesha—Quality Aluminum Casting Co., Lincoln Ave.,—special casting machines.

N. B., Fredericton—G. Scott—portable saw mill.

N. S., Clark's Harbour—A. Maxwell—complete machinery and equipment for machine shop.

Ont., Athens—W. G. Parish—addition machinery for sash and door manufacturing.

Ont., Ayton—V. Hahn, (planing mill)—sticker, cut off saws, molder and probably other equipment.

Ont., Brampton—J. W. Hewetson Co., Ltd., A. R. Hewetson, Secy. & Treas.—band saws, sanding machines and planing machines.

Ont., Elora—L. Kruezer—equipment for garage and repair shop.

Ont., Essex—Queen & Wigle, Talbot St.—equipment for garage and repair shop.

Ont., Grimsby—H. H. Farrell & Sons—special woodworking machinery for manufacture of fruit baskets, crates, etc.

Ont., Jackson's Point—W. Gilby—equipment for public garage and service station.

Ont., Meaford—Johnstone & Brown—general garage equipment and auto repair tools.

Ont., Newmarket—Moss & Holt—miscellaneous tools and equipment for public garage.

Ont., Stayner—F. J. Silverthorne—drill press, compressor and small lathe.

Ont., Stouffville—S. H. Swedlove, (furniture)—woodworking machinery.

Ont., Thornbury—E. H. Fields—addition machinery for sash and door manufacturing.

Ont., Thornhill—Graham & Findlay—equipment for repair and service garage.

Ont., Thornhill—G. H. Hooper—lathe and other equipment for garage.

Que., Montreal—E. Gagnon, 19 Aird St.—complete equipment for garage and service station.

Que., Montreal—E. Lajoie, 52 St. Elizabeth St.—complete equipment for public garage.

Que., St. David de Yamaska—Xavier Therronx & Freres—planers, saws, etc., for sash and door factory.

Opportunities for Future Business

Calif., Baldwin Park—The Bd. of Supervisors of Los Angeles County will receive bids until Nov. 17 for the construction of a 1 story, 80 x 40 ft. warehouse and machine shop.

Calif., Fresno—Murray Cabinet & Show Case Co., awarded the contract for the construction of a factory on E St. Estimated cost $40,000.

Calif., Lodi—Trustees of the Lodi Union High School Dist., will receive bids until Nov. 18 for the construction of 1 story manual training shops. Estimated cost $45,000. Wright & Satterlee, Bank of Italy Bldg., Stockton, Archts.

Calif., Los Angeles—Crondeley Fireproof Garage Co., c/o Shields, Fisher & Lake, Rowell Bldg., Fresno, Archts., awarded the contract for the construction of an 8 story garage and store building on 6th St. Estimated cost $400,000.

Calif., San Francisco—Pacific Elevator Co., 1129 Howard St., is having plans prepared for the construction of a 1 and 2 story shop building on Rausch St. Estimated cost $40,000. Baumann & Jose, 251 Kearny St., Archts.

Idaho, Nampa—Southern Pacific Co., 65 Market St., San Francisco, Calif., Engineering Dept., will receive bids until Nov. 18 for the construction of a group of 17 one story repair shop buildings.

Mass., Boston—J. D. Marr, c/o E. N. Adams, 86 Everett St., Arlington, Archt., is having plans prepared for the construction of a 2 story, 100 x 200 ft. garage at Old Colony Ave. and D St., South Boston. Estimated cost $175,000.

Mass., Lynn—J. E. Knox & Co., Broad St., manufacturers of rubber and cutting dies, awarded the contract for the construction of a 1 story factory on Broad St. Estimated cost $50,000. Wm. T. Reed Co., 200 Devonshire St., Engr.

Mass., Worcester—Morgan Construction Co., 14 Belmont St., manufacturers of mill machinery, awarded the contract for the construction of a 1 story, 150 x 250 ft. factory on Crescent St.

Mich., Detroit—Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts., will receive bids until Nov. 15 for the construction of a 12 story, 100 x 200 ft. garage at Adams and Randolph Sts., for Whitney Estate, David Whitney Bldg.

O., Cleveland—The Angell Nail & Chaplet Co., G. H. Angell, Pres., 2657 East 79th St., awarded the contract for the construction of a 1 story, 90 x 280 ft. factory on East 71st St. Estimated cost $100,000. Noted Oct. 9.

O., Cleveland—The Brookins Co., c/o G. F. Hammond, Zanesville, Archt., has completed plans for the construction of a 2 story, 35 x 140 ft. factory at East 40th St. and Carnegie Ave. for the manufacture of electric and gas light fixtures. Estimated cost $40,000.

O., Cleveland—Durand Steel Locker Co., c/o A. S. Holden, Plymouth Bldg., awarded the contract for the construction of a 1 story, 60 x 101 ft. factory on East 76th St. Estimated cost $40,000.

O., Cleveland—The Folberth Auto Specialty Co., 7920 Lake Ave., awarded the contract for the construction of a 2 story, 60 x 202 ft. factory building at 1311 West 80th St. Estimated cost $50,000.

O., Cleveland—Harris Automatic Press Co., R. V. Mitchell, Pres., 4510 East 71st St., awarded the contract for the construction of a 1 story factory. Estimated cost $40,000.

O., Dayton—National Cash Register Co., Main and K Sts., is having plans prepared for the construction of a 6 story, 600 x 500 ft. factory. Estimated cost $1,000,000. Private plans.

Pa., Philadelphia—Simplex Valve & Meter Co., 1112 North Broad St., plans the construction of a 1 story, 90 x 175 ft. factory, at 68th and Woodland. E. A. Wightman, Bankers Trust Bldg., Archt.

Pa., Whites Ferry—St. Michaels Industrial School, awarded the contract for the construction of a 2 story, 98 x 50 ft. shop building. Estimated cost $40,000.

Wis., DePere—A. J. Beauregard, 2nd and Reid Sts., will build a 2 story and basement, 40 x 50 and 50 x 32 ft. addition to woodworking plant on Reid St. Estimated cost $25,000. Private plans.

Wis., Hiles—C. Fish Lumber Co., Elcho, plans to rebuild a 2 story planing mill, recently destroyed by fire. Estimated cost $45,000. Architect not selected.

Wis., Milwaukee—Maynard Electric Steel Castings Co., Kilbourn Rd., will build a 1 story, 122 x 222 ft. foundry. Private plans.

Wis., Milwaukee—Standard Sanitary Mfg. Co., 311 5th St., awarded the contract for the construction of a 1 story, 62 x 177 ft. pipe storage and shop building on St. Paul Ave. Estimated cost $50,000.

Ont., Mitchell—Mitchell Mfg. Co., plans the construction of a 1 story, 100 x 450 ft. factory for manufacture of concrete mixing and handling machinery. Estimated cost $175,000.

Ont., Toronto—McLaughlin Motor Car Co., 128 Church St., is having plans prepared for the construction of a 2 story, 50 x 100 ft. garage and show room. Estimated cost $150,000. Hutton & Sauter, Bank of Hamilton Bldg., Hamilton, Archts.